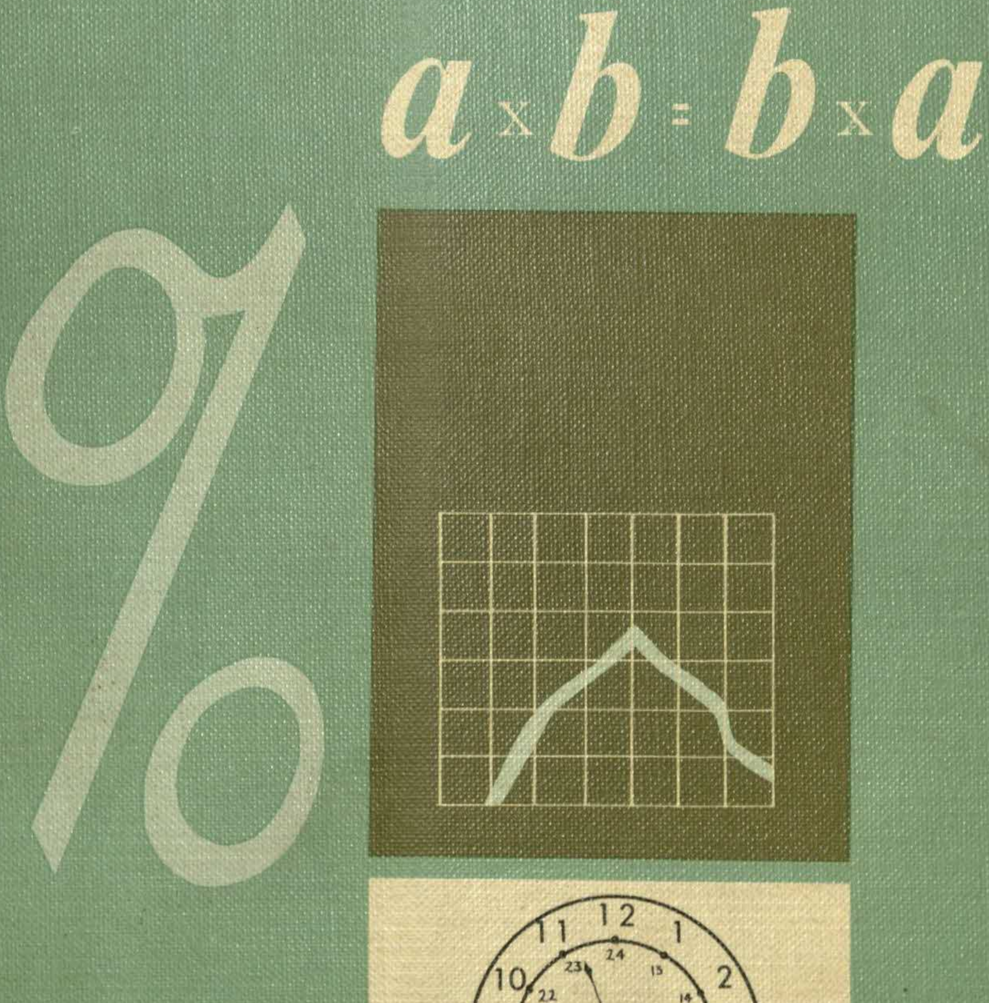
BROADENING KNOWLEDGE



TEACHER'S EDITION — ANNOTATED AND KEYED

3195

How to Use the TEACHER'S EDITION—Annotated and Keyed

FOR

3195(~~6269~~)

AMERICAN ARITHMETIC

SECOND EDITION

This Teacher's Edition is designed to be the greatest possible help to the busy teacher. Within one cover, it presents these distinctive features.

1. Pupil's Book. The full text of the pupil's book is printed in black and color exactly as it appears in the book used by the pupil.

2. Annotation. Concise statements of objectives and practical and helpful suggestions to the teacher are overprinted in a distinctive and legible color directly on the pages of the pupil's text.

3. Answers and Keys. Answers to all concrete problems are overprinted in color on the pages of the pupil's text. They are placed in the normal positions or as near to the problem as possible. There is no need for the teacher to work these problems or to turn to an answer section.

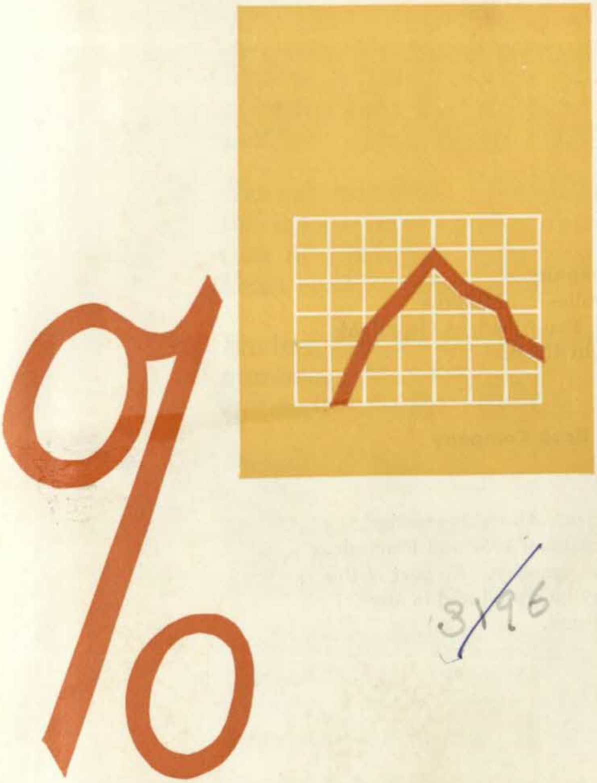
The keys to the more involved problems with their answers are given in the Teacher's Guide and Key at the end of the book.

4. Teacher's Guide and Key. For the convenience of the teacher, the Teacher's Guide and Key is printed on tinted paper immediately following the index in the pupil's text. The tinted paper is different enough from the white paper of the pupil's text to assist the teacher in turning easily to guide or key pages. A tint has been used that has been found scientifically easy on the eyes. The pages of the Teacher's Guide and Key are numbered separately with the letter G pointing out that guide and key pages are meant.

The Teacher's Guide and Key provides a full statement of the aims and detailed practical suggestions for each chapter and each page or group of pages in the pupil's text. Following the discussion of the treatment of each page is the key, working the more involved problems in full. References to pages in the workbook AMERICAN WORKSHOP are provided for those teachers using these workbooks. A list of audio-visual aids is provided at the end of the guide.

For advance study in preparation for the class session and for quick reference in the classroom, the Teacher's Edition—Annotated and Keyed offers the teacher all the above in this one volume, very little larger than the pupil's text itself.

3195



BROADENING KNOWLEDGE

American Arithmetic

Second Edition

3196

Clifford B. Upton
Formerly Professor of Mathematics
Teachers College, Columbia University

Kenneth G. Fuller
Mathematics Department
California State Polytechnic College

$a \times b = b \times a$

AMERICAN BOOK COMPANY

Library
Calcutta
B. C. Road

[illegible]
[illegible] 19. 5. 2008
[illegible] 13372

BROADENING KNOWLEDGE

American Arithmetic, Second Edition

Copyright © 1963 by American Book Company
New York Cincinnati Atlanta Dallas Millbrae
Under the Universal Copyright Convention, Pan-American Copyright Conventions, and the International Copyright Union

Philippines Copyright 1963 by American Book Company

Manufactured in the United States of America. All rights reserved. Certain portions of this book copyright © 1960 and 1957 and Philippines copyright 1961 and 1957 by American Book Company. No part of this book protected by the copyrights hereon may be reproduced in any form without written permission of the publisher.

Illustrations by Charles Dougherty, Sylvia Haggander, and William Riley
Covers by John Horton

EP 10 9 8 7 6 5 4 3 2 1

TEACHER'S EDITION—Annotated and Keyed
SL 10 9 8 7 6 5 4 3 2 1

Contents

Chapter		Page
1	Numbers through billions. The basic number facts and the use of number relationships in mastering these facts. The four fundamental operations with whole numbers. Roman numerals. Round numbers. Bar graphs. Problem solving.	1
2	Keeping accounts. Two-step problems. How to take and score the Improvement Tests. Reteaching of the addition and subtraction of fractions of the preceding grade. Three-step problems. Least common denominator. Problem solving.	43
3	Finding fractional parts. Multiplication of fractions and mixed numbers. Measures of length. Finding perimeters and areas of rectangles. Square measure. Vocabulary study. Problem solving.	85
4	Meaning of decimals. Reading and writing decimals through thousandths. Place value in numbers. Addition and subtraction of decimals. Multiplication of a 4-place number by a 3-place number. Magic squares. Multiplication of decimals by whole numbers and decimals. Problem solving.	119
5	Tests of divisibility. Changing fractions to lowest terms. Three-place divisors. Vocabulary study. Division of fractions and mixed numbers. Comparing numbers by division. Finding the whole when a part is given. Problem solving.	161
6	Dividing decimals by whole numbers. Rounding off decimal results. Changing fractions to decimals. Line graphs. Measures of weight. Dividing decimals by decimals. Vocabulary study. Estimating answers. Problem solving.	197
7	Scale drawing. Bills and receipts. Finding the volumes of rectangular solids. Cubic measure. Magic squares. Adding and subtracting compound numbers. Picture graphs. Problem solving.	233
8	Twenty-four-hour clock. Meaning of per cent. Finding a per cent of a number. Problem solving. Review of the year's work.	271
	Tables for reference and number facts with answers	305
	More practice	310
	Index	330

Before beginning the work in this book refer to "Suggestions to Teachers," pages 327-329, and Teacher's Guide and Key, pages 3-7. These sections contain discussion and explanation of number relationships, long division, improvement tests, and so on, with page references and valuable teaching suggestions.

Reteach and review skills and understandings taught in previous grades. See Teacher's Guide and Key, page 8, for specific aims of Chapter 1.

Review problem solving and some arithmetic skills, such as, finding fractional part of number, calculating time, estimating rate of travel, skills in fundamental operations (pages 1–3).

Chapter 1

Lewis and Clark Expedition

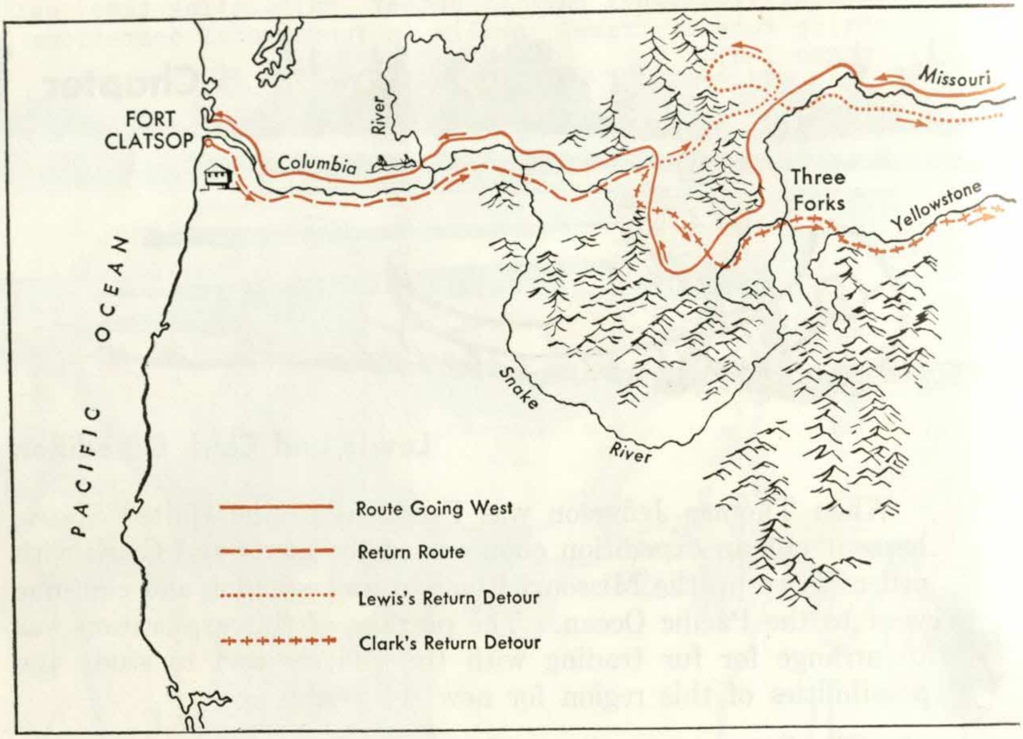
When Thomas Jefferson was President of the United States, he sent out an expedition commanded by Lewis and Clark with orders to go up the Missouri River to its beginning and continue west to the Pacific Ocean. The purpose of this exploration was to arrange for fur trading with the Indians and to study the possibilities of this region for new settlers.

1. The Government allowed $2500 to cover the cost of supplies for the expedition. Of this amount $\frac{1}{4}$ was to be spent for red coats, bright-colored handkerchiefs, tomahawks, knives, looking glasses, flags, and beads as gifts for the Indians. How much money was to be spent on Indian gifts? $ 625*

2. Lewis and Clark left St. Louis May 14, 1804, and started up the Missouri River. On October 31 they reached a place near what is now Bismarck, North Dakota. They built a camp there, called Fort Mandan, where they spent the winter. How many days did the trip to Fort Mandan take? 170 To find the number of days, think: "After May 14, there are 17 days left in May. There are 30 days in June, 31 in July, 31 in August, 30 in September, and 31 in October." Add these numbers to find the number of days.

3. The distance from St. Louis to Fort Mandan was 1600 mi. Did the party travel about 9 mi. a day or about 10 mi. a day? 9 Multiply 170 by 9; then multiply 170 by 10 and see which is closer to 1600. See the map on pages 2 and 3.

*For convenience here, only numerical part of answer is given. Pupils should give complete answers and process steps, as shown in Teacher's Guide and Key for each page. This procedure is used throughout the text.



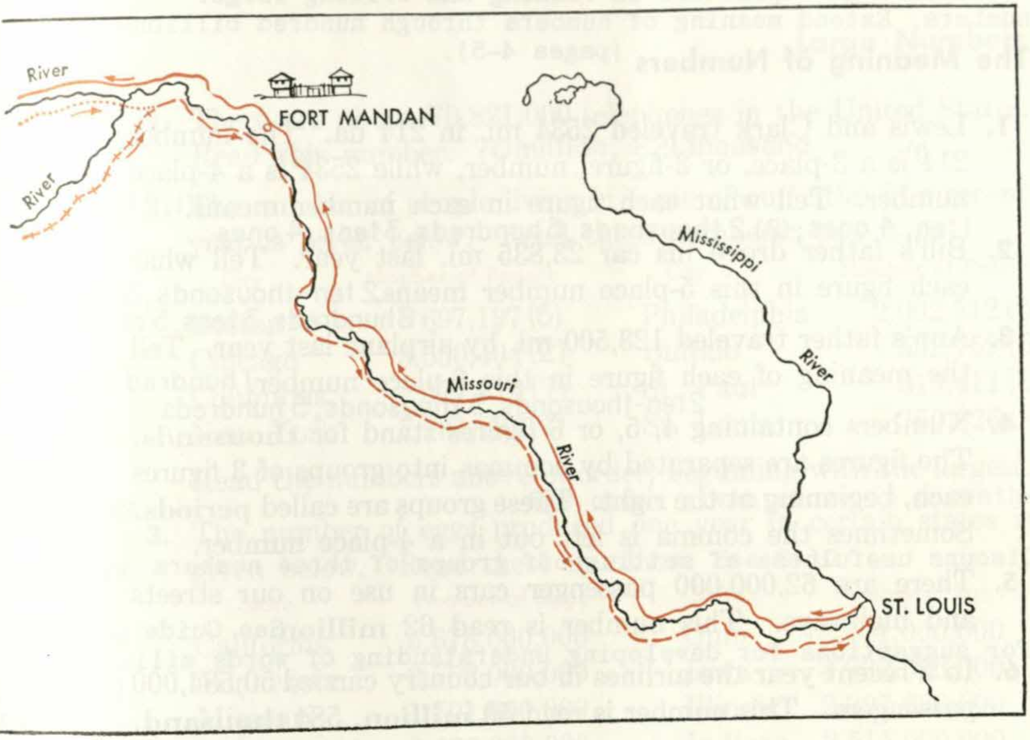
Lewis and Clark Expedition

1. After spending the winter at Fort Mandan, Lewis and Clark left the Fort on April 7, 1805, and continued their trip up the Missouri River to a place called Three Forks where the Missouri proper begins. They arrived there on July 25. How many days did the trip take? See the map above.
109

2. The men then crossed the Rocky Mountains and continued west until they came to the Columbia River. On October 16 they started down the Columbia in canoes and reached the Pacific Ocean on November 7, 1805, where they built a camp called Fort Clatsop in which they spent the winter. How many days did the Columbia River trip take? 22

3. The trip from Fort Mandan to Fort Clatsop took a total of 214 da. and covered 2534 mi. Was the speed of travel on this trip about 11 mi. a day or about 12 mi. a day? 12 In ex. 3, page 1, you are told that the men traveled 1600 mi.

Discuss problems (pages 1–3) with pupils, explaining how to read them carefully with questions in mind: that is, what does the problem ask them to find, what facts are known, what process or processes should be used, how should problem be written in numbers.



in going from St. Louis to Fort Mandan. How many miles in all did they travel on the complete trip across the country from St. Louis to Fort Clatsop? 4134

4. Lewis and Clark left Fort Clatsop on March 23, 1806, to begin the long journey back to St. Louis. When they reached the Rocky Mountains the expedition divided into two groups. Later, at the mouth of the Yellowstone River, Clark's party rejoined Lewis and his party for the rest of the trip home. They arrived back in St. Louis on September 23, 1806. How many days did the return trip take? 184 See the map above.

5. When they arrived in St. Louis there were 33 men of the party who had been on the complete round trip. As an extra reward to these men, the Government told them that each man could put in a claim for 320 acres of land in this new region. Find the total number of acres of land the Government was ready to give these men. 10,560

As problems are discussed with pupils note particular skill areas (see page 1) which cause difficulty. Plan for later specialized review or reteaching based on class or individual needs.

Review and give practice in reading and writing larger numbers. Extend meaning of numbers through hundred billions (pages 4–5).

The Meaning of Numbers

1. Lewis and Clark traveled 2534 mi. in 214 da. The number 214(1) is a 3-place, or 3-figure, number, while 2534(2) is a 4-place number. Tell what each figure in each number means. (1) 2 hundreds, 1 ten, 4 ones; (2) 2 thousands, 5 hundreds, 3 tens, 4 ones
2. Bill's father drove his car 23,835 mi. last year. Tell what each figure in this 5-place number means. 2 ten-thousands, 3 thousands, 8 hundreds, 3 tens, 5 ones
3. Ann's father traveled 123,500 mi. by airplane last year. Tell the meaning of each figure in this 6-place number. 1 hundred-thousand, 2 ten-thousands, 3 thousands, 5 hundreds
4. Numbers containing 4, 5, or 6 figures stand for **thousands.** The figures are separated by commas into groups of 3 figures each, beginning at the right. These groups are called **periods.** Emphasize. Sometimes the comma is left out in a 4-place number. Discuss usefulness of setting off groups of three numbers with commas.
5. There are 62,000,000 passenger cars in use on our streets and highways. This number is read 62 **million.** See Guide page 9 for suggestions for developing understanding of words million and billion.
6. In a recent year the airlines in our country carried 50,584,000 passengers. This number is read 50 **million,** 584 **thousand.**
7. Recently there were 3,550,404 people living in Chicago. This number is read 3 **million,** 550 **thousand,** 404.
8. During one year our post offices handled 59,077,633,000 pieces of mail. This large number has 11 places and is read 59 **billion,** 77 **million,** 633 **thousand.**
9. Numbers containing 7, 8, or 9 figures stand for **millions.** Numbers containing 10, 11, or 12 figures stand for **billions.** Millions is the third period counting from the right. Billions is the fourth period. Here are the names of the periods:

Billions	Millions	Thousands	Ones
281,	372,	640,	357,

The number above is 281 **billion,** 372 **million,** 640 **thousand,** 357. It has 12 places. Tell what each figure means. See G–9.

10. In each number put commas in the proper places to separate the number into periods; then read the numbers: 63,593,221; 4,882,935; 293,645,707; 8,539,645,279; 321,456,035,232; 7,543,007. See G–9.

In discussing 214 da. in ex. 1, pupils should realize that 2 hundreds may mean 2 hundreds, 20 tens, or 200 ones; that 1 ten may mean 10 ones; and that 214 may mean 214 ones. Discuss other numbers similarly and give practice in regrouping them.

1. There are about 70,821,000 telephones in the United States. Read this number. 70 million, 821 thousand

2. The number of people living in some of our cities in a recent year is given below. Read these numbers: See G-10.

City	Number of People	City	Number of People
Boston	697,197 (5)	Philadelphia	2,002,512 (3)
Chicago	3,550,404 (2)	Buffalo	532,759 (6)
Columbus	471,316 (7)	St. Paul	313,411 (8)
New York	7,781,984 (1)	St. Louis	750,026 (4)

Read the numbers above in order, beginning with the largest. See order given above in parentheses.

3. The number of eggs produced one year in certain states is given below. Read these numbers: See G-10.

State	Number of Eggs	State	Number of Eggs
California	5,678,000,000	Ohio	2,471,000,000
Minnesota	3,552,000,000	Iowa	4,732,000,000
Missouri	1,701,000,000	Illinois	2,397,000,000
Pennsylvania	3,488,000,000	Indiana	2,515,000,000

Which of these states produced the largest number of eggs? California

Have pupils show numbers in ex. 4-11 on place-value diagram (see ex. 9 on page 4).

Write these numbers in figures:

4. Four million, three hundred twenty thousand, six hundred. 4,320,600

5. Fifteen billion, eleven million, nine thousand, sixty. 15,011,009,060

6. Six hundred thirty-five million, four hundred thousand. 635,400,000

7. Seven billion, fifteen thousand, nine hundred thirty. 7,000,015,930

8. Fifty million, eight hundred nine thousand, twenty-four. 50,809,024

9. One hundred eighty billion, two hundred ninety million, nineteen thousand, forty-six. 180,290,019,046

10. Twelve million, five hundred thirteen thousand, eight hundred seventeen. 12,513,817

11. Bring to class newspaper clippings containing numbers with 10 or more figures. Read these numbers.

Emphasize fact that value of each figure depends on place it occupies. Discourage use of "and" in reading numbers. Have pupils make charts for ex. 11, showing number in figures and words, and uses of larger numbers.

Present diagnostic test of pupils' mastery of addition facts. See G-10 for oral procedure.

The 100 Addition Facts

This is a test on the addition facts. You should be able to give all the sums orally within the time stated by the teacher. Make a list of any facts that give you trouble and practice on them:

1.	3 1 4	8 4 12	9 8 17	0 8 8	4 5 9	5 3 8	8 5 13	4 0 4	6 5 11	3 9 12
2.	4 2 6	1 9 10	0 4 4	2 3 5	3 5 8	5 7 12	1 2 3	2 9 11	7 9 16	8 0 8
3.	5 2 7	6 1 7	2 6 8	8 3 11	1 0 1	6 3 9	2 8 10	0 6 6	6 9 15	4 7 11
4.	5 8 13	9 0 9	7 8 15	9 4 13	2 7 9	8 8 16	9 2 11	1 1 2	3 0 3	7 7 14
5.	2 1 3	3 7 10	5 0 5	8 2 10	4 4 8	1 6 7	3 2 5	9 3 12	2 0 2	1 3 4
6.	7 6 13	6 0 6	3 4 7	7 2 9	4 9 13	1 4 5	7 1 8	8 6 14	0 9 9	8 9 17
7.	4 8 12	0 3 3	5 6 11	6 4 10	1 8 9	5 9 14	7 0 7	6 8 14	4 1 5	2 2 4
8.	8 1 9	6 7 13	0 5 5	5 4 9	1 7 8	3 3 6	2 5 7	0 1 1	8 7 15	6 2 8
9.	0 2 2	5 1 6	9 9 18	4 3 7	7 5 12	0 7 7	9 6 15	5 5 10	9 7 16	7 3 10
10.	9 1 10	4 6 10	3 8 11	0 0 0	2 4 6	1 5 6	6 6 12	3 6 9	7 4 11	9 5 14

To the Teacher. See the suggestions on page 327 for giving this diagnostic test on the fundamental addition facts.

Note if pupils need reinforcement and/or reteaching of facts. Have pupils make study cards for facts they missed or were unsure of. Use various relationships between addition facts in reteaching (see ex. 1-4 on page 14).

Review commutative principle for addition, identity element of addition, and other relationships between basic addition facts.

Related Facts

If you have difficulty with the addition facts, you can use related facts for help as shown below.

1. The sum of 4 and 8 is the same as the sum of 8 and 4. If you know that the sum of 8 and 4 is 12, then 12 is also the sum of 4 and 8. **If *a* and *b* stand for any two numbers, then $a + b = b + a$.** This is called the commutative principle for addition. Tell what this principle means in words.

2. What related fact can help you if you forget 5 and 7? 7 and 5 8 and 6? 6 and 8 3 and 5? 5 and 3 7 and 9? 9 and 7 5 and 8? 8 and 5

3. The sum of 9 and 6 is the same as the sum of 10 and 5. If you forget the sum of 9 and 6, take 1 from 6 and add it to 9, making 10. Now you have 10 and 5, or 15. What can you do if you forget 9 and 4? $(9+1)+3$ 7 and 9? $6+(9+1)$ 9 and 5? $(9+1)+4$

4. The sum of 6 and 7 is 1 more than the sum of 6 and 6. If you know that 6 and 6 equal 12, then 6 and 7 equal 1 more than 12, or 13. What can you do if you forget 7 and 8? $(7+7)+1$ 5 and 6? $(5+5)+1$ 8 and 9? $(8+8)+1$ You see that the doubles help you to add numbers that are near doubles.

5. It is easy to add 0 to any other number. 7 and 0 equal 7. How many are 6 and 0? 6 4 and 0? 4 0 and 8? 8 0 and 0? 0 **If n stands for any number, then $n + 0 = n$.** What does $0 + n$ equal? n Tell how to find the sum of 0 and any other number. Zero plus any other number equals the number.

6. The addition facts help you to add larger numbers. You know that $3 + 5 = 8$. So $13 + 5 = 18$, $23 + 5 = 28$, $33 + 5 = 38$, $43 + 5 = 48$, and so on.

7. You know that $8 + 7 = 15$. So $18 + 7 = 25$, $28 + 7 = 35$, $38 + 7 = 45$, and so on.

Add 5 to each number. Do the work mentally:

8. 63 68 49 54 17 22 84 89 32 37 56 61 93 98 28 33

9. 91 96 26 31 34 39 68 73 77 82 43 48 57 62 88 93

10. Add 6 to each number in ex. 8 and 9.(1) Add 8;(2) add 9.(3)

(1) 69,55,23,90,38,62,99,34; 97,32,40,74,83,49,63,94 (2) 71,57,25,92,40,64,101,36; 99,34,42,76,85,51,65,96 (3) 72,58,26,93,41,65,102,37; 100,35,43,77,86,52,66,97

Note that the following relationships are reviewed: ex. 1, 2, commutative principle for addition; ex. 3, adding 9; ex. 4, near doubles; ex. 5, identity element of addition, ex. 6, 7; adding by endings. Have pupils illustrate these relationships with other facts.

Review column addition with 4 addends and vocabulary words "addend" and "sum" (pages 8-9).

Column Addition

1. Problem Find the sum of 3, 8, 4, and 9. 24

Explanation Write the numbers in a column and add up. Think "9, 13, 21, 24." Write the answer 24. In addition the numbers you add are called the **addends.** The answer is called the **sum.** To check, begin at the top of the column and add down. Column addition illustrates the associative principle for addition.

3 8 4 9	Addends
24	Sum

2. Find the sum of these numbers: 4, 3, 9, 6, 2. 24

3. On five days John worked 2 hr., 3 hr., 4 hr., 2 hr., and 4 hr. How many hours in all did John work? 15

Add up. Check by adding down. Write answers on folded paper:

4.	8	4	5	9	8	4	5	8	6
	4	7	6	4	6	6	7	6	8
	7	5	4	7	9	7	5	8	9
	6	5	8	3	5	5	9	7	4
	3	7	4	9	1	8	6	9	7
	4	2	5	9	7	3	8	6	7
	32	30	32	41	36	33	40	44	41

5.	84	22	79	23	53	69
	78	53	32	75	81	91
	92	36	63	69	32	75
	43	59	46	27	26	18
	297	170	220	194	192	253
6.	48	47	76	94	59	45
	67	56	96	59	60	38
	16	65	74	18	38	68
	83	78	59	97	41	50
	58	69	85	34	49	37
	272	315	390	302	247	238
7.	37	53	76	61	99	54
	29	61	80	87	88	77
	42	79	39	40	27	69
	48	89	70	61	69	56
	63	32	42	28	81	47
	29	16	24	53	74	89
	248	330	331	330	438	392

To the Teacher. For use of folded paper, see page 56.

Begin class vocabulary chart, showing arithmetic terms, meaning, illustrated example. Remind pupils that they add up, and check by adding down. Have pupils do some examples orally to check adding by endings and carrying.

Adding Larger Numbers

$$\begin{array}{r}473\\298\\643\\469\\534\\\hline 2417\end{array}$$

1. To add the numbers in the example at the right, start at the bottom of the ones column and add up. Think, "4, 13, 16, 24, 27." Write 7 in ones place and carry 2 to the tens column. Then think, "5, 11, 15, 24, 31." Write 1 in tens place and carry 3 to the hundreds column. Add hundreds column the same way.

2. In ex. 1, when you carry the 2 of 27 to the second column, what does the 2 stand for? 2 tens When you carry the 3 of 31 to the third column, what does this 3 stand for? 3 hundreds

3. The best way to check column addition is to add down each column. In the example above, as you add down the first column think, "11, 14, 23, 27." The sum is 27 again, so the first column is checked. Carry the 2 of 27 to the top of the second column and check that column by adding down. Then check the third column.

Add up. Check by adding down: Stress checking.

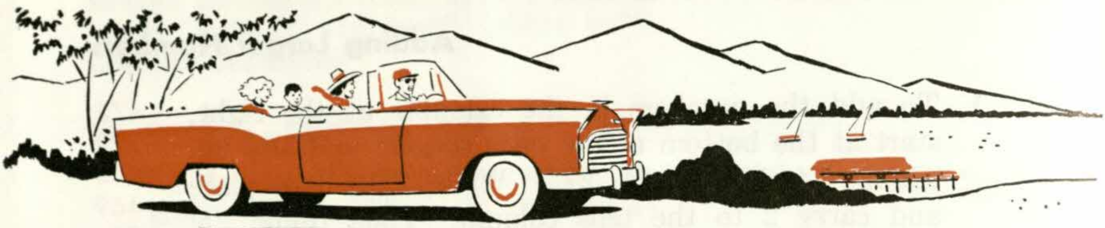
4. $$\begin{array}{r}654\\349\\586\\908\\645\\\hline 3142\end{array}\quad\begin{array}{r}376\\627\\774\\635\\402\\\hline 2814\end{array}\quad\begin{array}{r}493\\772\\587\\764\\384\\\hline 3000\end{array}\quad\begin{array}{r}459\\238\\652\\899\\113\\\hline 2361\end{array}\quad\begin{array}{r}116\\854\\357\\896\\637\\\hline 2860\end{array}\quad\begin{array}{r}708\\723\\228\\995\\346\\\hline 3000\end{array}$$

5. $$\begin{array}{r}452\\176\\578\\611\\574\\\hline 2391\end{array}\quad\begin{array}{r}369\\445\\171\\847\\289\\\hline 2121\end{array}\quad\begin{array}{r}378\\493\\502\\469\\613\\\hline 2455\end{array}\quad\begin{array}{r}642\\515\\479\\698\\729\\\hline 3063\end{array}\quad\begin{array}{r}830\\649\\858\\592\\304\\\hline 3233\end{array}\quad\begin{array}{r}329\\273\\289\\258\\758\\\hline 1907\end{array}$$

6. $$\begin{array}{r}2419\\462\\928\\163\\\hline 3972\end{array}\quad\begin{array}{r}1719\\634\\2369\\417\\\hline 5139\end{array}\quad\begin{array}{r}799\\407\\512\\3124\\\hline 4842\end{array}\quad\begin{array}{r}2602\\1319\\746\\3247\\\hline 7914\end{array}\quad\begin{array}{r}1470\\3891\\1785\\2609\\\hline 9755\end{array}$$

More Practice. See ① on page 310. See page 329 for use of "More Practice" pages.

Some pupils may need further review of regrouping of ones for tens, tens for hundreds, and so on. Use place pocket chart to demonstrate. Have pupils explain how and why they are carrying in ex. 4–6.



Problems and Practice

Review word problems with addition thought patterns.

1. Last summer Ann's father took his family on a trip. It cost $37.85 for gasoline and oil, $94.80 for meals and rooms, and $24.75 for other things. Find the total cost of this trip. $ 157.40
2. When Jack's family went on a trip, Jack kept a record of the number of miles traveled each day. For the first day his record showed a distance of 287 mi.; for the second day, 316 mi.; for the third day, 269 mi.; and for the fourth day, 307 mi. Find the total distance traveled during the first four days of the trip. 1179 mi.
3. Before school opened in the fall, Helen and her mother went shopping. They bought for Helen a dress for $12.95, a sweater for $3.49, a pair of shoes for $7.50, and a raincoat for $9.98. Find the total cost of their purchases. $ 33.92
4. At the Smith School there are 27 children in the first grade, 31 in the second grade, 36 in the third grade, 29 in the fourth grade, 32 in the fifth grade, and 28 in the sixth grade. How many children in all go to the Smith School? 183
5. Mr. White sold 179 doz. eggs in January, 215 doz. in February, 273 doz. in March, 295 doz. in April, 216 doz. in May, and 196 doz. in June. How many dozen eggs did Mr. White sell in this six-month period? 1374

Copy, add, and check:

6. $15.16 + $8.49 + $2.05 + $3.97 + $10.50 + $3.15 $ 43.32

7. $7.87 + $24.65 + $13.24 + $8.53 + $1.98 + $12.46 $ 68.73

8. $3.63 + $35.79 + $4.44 + $11.45 + $18.75 + $3.20 $ 77.26

9. $36.93 + $8.29 + $5.56 + $12.72 + $46.60 + $7.38 $ 117.48

Instruct pupils to read problems carefully (see page 2). After ex. 1–5 are completed, let different pupils explain their work. In ex. 6–9 note difficulties with ragged columns or exchange of cents, dimes, dollars.

Present diagnostic test of pupils' mastery of subtraction facts.

The 100 Subtraction Facts

This is a test on the subtraction facts. You should be able to give all the answers orally within the time stated by the teacher. Make a list of any facts that give you trouble and practice on them:

1.	4 3 1	9 1 8	11 6 5	15 6 9	7 5 2	14 8 6	8 5 3	10 3 7	12 9 3	4 4 0
2.	3 1 2	1 1 0	7 3 4	11 3 8	8 8 0	5 4 1	15 8 7	10 5 5	4 1 3	0 0 0
3.	9 9 0	7 6 1	12 3 9	10 6 4	16 8 8	13 6 7	15 9 6	9 7 2	13 8 5	9 4 5
4.	12 7 5	7 0 7	13 9 4	9 2 7	11 8 3	12 6 6	11 7 4	17 8 9	8 6 2	5 1 4
5.	15 7 8	10 4 6	14 9 5	6 6 0	8 4 4	10 2 8	8 1 7	12 8 4	4 0 4	7 2 5
6.	7 4 3	5 3 2	9 0 9	8 3 5	11 5 6	3 3 0	17 9 8	4 2 2	9 3 6	10 7 3
7.	13 5 8	7 1 6	18 9 9	2 1 1	13 7 6	6 4 2	12 4 8	6 0 6	14 5 9	2 2 0
8.	16 7 9	11 4 7	8 7 1	12 5 7	13 4 9	6 1 5	9 5 4	3 2 1	10 9 1	6 3 3
9.	9 6 3	11 9 2	5 0 5	7 7 0	8 2 6	10 1 9	2 0 2	9 8 1	6 5 1	1 0 1
10.	16 9 7	6 2 4	10 8 2	3 0 3	14 7 7	11 2 9	5 5 0	8 0 8	5 2 3	14 6 8

To the Teacher. See the suggestions on page 327 for giving this diagnostic test on the fundamental subtraction facts.

See G-10 (page 6) for oral procedure. Have pupils make fact cards for further study, and let partners test each other. Use relationships among numbers in reteaching, for example, related addition facts, doubles, and so on.

Reteach subtraction as the inverse operation of addition; review identity element and vocabulary of subtraction.

Subtraction

1. If you forget the answer to a subtraction fact, you can get it easily in this way. If you forget what 9 from 13 equals, think, "9 and what equal 13?" If you remember that 9 and 4 equal 13, then you know that 9 from 13 is 4. How should you think if you forget the answer to 7 from 12? "7 and what equal 12?" to 4 from 11? "4 and what equal 11?" to 8 from 17? "8 and what equal 17?" to 9 from 16? "9 and what equal 16?"

2. It is easy to subtract 0 from any number. 5 − 0 = 5. **If n stands for any number, then $n - 0 = n$.** Tell what number goes in each space:

   4 − 0 = .4. 7 − 0 = .7. 9 − 0 = .9. 2 − 0 = .2.

3. It is also easy to subtract a number from itself. 8 − 8 = 0. **If n stands for any number, then $n - n = 0$.** Tell what number goes in each space:

   6 − 6 = .0. 7 − 7 = .0. 5 − 5 = .0. 9 − 9 = .0.

4. **Problem** Subtract 185 from 314.

   Explanation Write 185 under 314. Think, "14 − 5 = 9." Write 9. Think, "10 − 8 = 2." Write 2. Think, "2 − 1 = 1." Write 1. The answer is 129.

314	Minuend
185	Subtrahend
129	Remainder or Difference

Add words to class chart.

5. To check a subtraction example, add the remainder to the subtrahend, **adding up.** You should get the minuend.

6. Explain how the remainder is found in each example below:

79	90	127	942	500	286	428
47	18	59	686	237	192	424
32	72	68	256	263	94	4

Subtract and check. Write the answers on folded paper:

7.	81	113	417	871	723	700	4000
	37	87	283	236	189	234	1275
	44	26	134	635	534	466	2725
8.	63	146	626	600	814	562	2206
	29	29	491	417	297	129	997
	34	117	135	183	517	433	1209

More Practice. See ② on page 310. Use for reteaching.

To the Teacher. See page 329 for the additive method of subtraction.

Use place pocket chart and materials (bundled splints and single ones) to demonstrate steps in subtraction in ex. 6. Let pupils do ex. 7–8 independently. Then have different pupils explain how and why they regrouped, using pocket chart.

Use this page to determine if some pupils need complete reteaching program in subtraction. Use materials and stress meanings in reteaching.

Problems and Practice

1. The sixth grade sold 123 tickets to the spring folk dances and the fifth grade sold 89 tickets. How many more tickets did the sixth grade sell than the fifth grade? 34

2. Mary received $10.00 from her grandfather on her birthday. If she buys a blouse for $3.69, how much money will she have left? $6.31

3. Henry and his family are making an automobile trip to a city 500 mi. away. On the first day they traveled 284 mi. How many more miles do they have to travel? 216

4. Last year 9241 school children borrowed books from the public library. Of these borrowers 4728 were grade school pupils. How many borrowers were high school pupils? 4513

Subtract and check. Write answers on folded paper:

5.	4833 1246 3587	2919 2437 482	6534 2635 3899	73146 57457 15,689	70000 42398 27,602
6.	1655 687 968	5000 2465 2535	4288 1535 2753	16276 8628 7648	35643 17987 17,656
7.	5018 4568 450	7188 3759 3429	4000 2152 1848	91421 72394 19,027	14932 6165 8767
8.	8587 2338 6249	8783 6994 1789	4630 3586 1044	60000 47647 12,353	73946 72969 977
9.	8000 4323 3677	7241 6895 346	1652 799 853	73417 19431 53,986	60900 11689 49,211

10. Take $74.96 from $169.85. $94.89

11. How much less than 36,145 is 30,759? 5386

12. How much more is 50,000 than 23,516? 26,484

Do ex. 1-5 orally with class. Be sure they understand subtraction expressions. Have pupils do ex. 6-12 independently. Give pupils who seem to have difficulty opportunity to do computations aloud, to check understandings.

Present diagnostic test of pupils' mastery of multiplication facts. Review multiplication process and principles.

Multiplication

1. The 100 multiplication facts look like the 100 addition facts on page 6, but you multiply the numbers. Turn to page 6 and try to **multiply** all the numbers orally within the time stated by the teacher.

2. The multiplication facts go together in pairs. For example, $6 \times 7 = 42$ and $7 \times 6 = 42$. So $6 \times 7 = 7 \times 6$. **If a and b stand for any two numbers, then $a \times b = b \times a$.** This is called the commutative principle for multiplication. Tell what this principle means in words. Reversing multiplicand and multiplier does not change the product.

3. If you forget the answer to 6×7, reverse the numbers and try 7×6. If you know that $7 \times 6 = 42$, this tells you that $6 \times 7 = 42$. What related facts can help you if you forget 4×8? 9×7? 3×7? 6×5? 5×8?
8 x 4 7 x 9 7 x 3 5 x 6 8 x 5

4. It is easy to multiply 0 by any number. $3 \times 0 = 0$ because $0 + 0 + 0 = 0$. **If n stands for any number, then $n \times 0 = 0$.** What does $0 \times n$ equal? 0 What number goes in each space?

$5 \times 0 =$ .0. $0 \times 7 =$ .0. $4 \times 0 =$ .0. $0 \times 6 =$ .0.

5. It is also easy to multiply 1 by any number. $4 \times 1 = 4$, because $1 + 1 + 1 + 1 = 4$. **If n stands for any number, then $n \times 1 = n$.** What does $1 \times n$ equal? n What number goes in each space?

$7 \times 1 =$ .7. $1 \times 5 =$ .5. $9 \times 1 =$ .9. $1 \times 3 =$ .3.

6. When you forget a multiplication fact you can get help from a known fact which is near it. Suppose you forget 6×8, but know 5×8. You can find 6×8 by adding 5×8 and 8. So $6 \times 8 = 40 + 8 = 48$. This can be done because 5 eights and 1 eight equal 6 eights.

7. Tell how you can find 5×9 if you know 4×9, by using the plan in ex. 6. Tell how to find 7×8 by this plan.
$5 \times 9 = (4 \times 9) + 9 = 45$ $7 \times 8 = (6 \times 8) + 8 = 56$

Give the answers. Do the work inside the parentheses first.

8. $(6 \times 5) + 4$ 34 $2 + (4 \times 7)$ 30 $(9 \times 8) + 7$ 79 $3 + (5 \times 7)$ 38

9. $(9 \times 3) + 7$ 34 $2 + (5 \times 9)$ 47 $(6 \times 7) + 4$ 46 $6 + (9 \times 9)$ 87

Note that the following relationships are reviewed: ex. 2, 3, commutative principle for multiplication; ex. 5, identity element of multiplication.

Review multiplication process and vocabulary.

Multiplication

1. **Problem** There are 52 seats in each coach of the new streamlined train. How many seats are there in all if there are 14 coaches in the train? 728

52	**Multiplicand**
14	**Multiplier**
208 52	**Partial Products**
728	**Product**

Explanation You multiply 52 by 14.

To do this, first multiply 52 by the 4 of 14, which gives 208. Write 208 so that the 8 comes under the 4 by which you multiplied. Then multiply 52 by the 1 of 14, which gives 52. Write 52 so that the 2 comes under the 1 by which you multiplied. Since the 1 of 14 really means 10, you have multiplied 52 by 10, which gives 520. You drop the 0 in ones place and write 52 as shown above with the 2 in tens place. Add the two products as they stand, which gives 728. There are 728 seats in all. Stress.

2. In multiplication the number that you multiply is the **multiplicand,** the number by which you multiply is the **multiplier,** and the answer is the **product.** The numbers you add to get the product are called the **partial products.**

3. The multiplicand and the multiplier are called **factors** of the product. In ex. 1 the numbers 52 and 14 are factors of the product 728. Add terms in ex. 2, 3 to arithmetic vocabulary chart.

4. Multiply each number by 5 and add 3 to the product:

3 18 9 48 2 13 7 38 0 3 6 33 1 8 8 43 5 28 4 23

5. Multiply each number in ex. 4 by 8 and add 6 to the product.
30, 78, 22, 62, 6, 54, 14, 70, 46, 38

Multiply. Check by going over your work:

6. 32	46	72	38	68	59	82
14	19	32	27	49	24	67
448	874	2304	1026	3332	1416	5494

More Practice. See ③ on page 310.

See G-13 and page 327 for procedure of giving multiplication test. If some pupils have not mastered facts, provide remedial work (see pages 20-21). In ex. 1 stress order of multiplication (ones first) and reasons for placement of numbers in partial products.

Reteach steps in multiplication (pages 16-17).

Using Multiplication

1. Henry and his father are putting 18 tomato plants in one row in the garden. If they plant 4 rows of tomatoes, how many tomato plants will they have all together? 72

2. Mr. Johnson shipped 32 cases of eggs to the city last week. There are 30 doz. eggs in a case of eggs. How many dozen eggs did Mr. Johnson ship? 960 How many eggs is that? 11,520

3. The pupils in the sixth grade are planning a trip to the history museum. Each pupil will pay $1.25 for the trip. How much in all will 27 pupils pay for the trip? $ 33.75

4. Mary sold 123 packages of flower seeds at 8¢ a package. How much money did she get for them? $ 9.84

▸ Remember that 123 × 8 is the same as 8 × 123. The answer will be in cents and should be changed to dollars and cents.

Multiply. Check by going over your work:

5.	214 13 2782	273 24 6552	571 43 24,553	7234 4 28,936	1836 7 12,852	$29.41 9 $ 264.69
6.	827 568 469,736	736 179 131,744	986 342 337,212	4165 65 270,725	2054 87 178,698	$98.50 19 $ 1871.50
7.	850 893 759,050	921 795 732,195	708 352 249,216	1963 38 74,594	5140 24 123,360	$30.94 58 $ 1794.52
8.	908 246 223,368	789 317 250,113	635 145 92,075	3647 49 178,703	4500 71 319,500	$15.67 83 $ 1300.61
9.	167 167 27,889	903 684 617,652	453 628 284,484	2705 96 259,680	9162 52 476,424	$32.04 36 $ 1153.44

Let different pupils explain work in ex. 1-4 at board. Point out that multiplying by tens or hundreds is same as by ones, except answer begins in tens or hundreds place.

More about Multiplication

1. **Problem** In the new Lincoln High School there will be 20 classrooms. If 36 chairs are needed for each classroom, how many classroom chairs will be needed in all? 720

Explanation When you multiply 36 by 20 you can drop the partial product shown in A which you get when you multiply 36 by 0. It saves time to arrange the work as in B, letting the 0 of the multiplier stand out at the right. When you begin, write the 0 of 20 below the line and then multiply by 2. Now multiply 73 by 30. 2190

$$\begin{array}{r} \text{A} \\ 36 \\ \underline{20} \\ 00 \\ \underline{72} \\ 720 \end{array} \qquad \begin{array}{r} \text{B} \\ 36 \\ \underline{20} \\ 720 \end{array}$$

2. **Problem** The airline distance between New York and Chicago is 713 mi. One pilot has made this flight 203 times. Find the total number of miles he has flown on this trip. 144,739

Explanation When you multiply 713 by 203 you can do the work as shown in A. But it saves time to do the work as shown in B. The partial product you get when you multiply 713 by 0 is dropped. You

Emphasize.→ must be sure to place the 6 of 1426 directly under the 2 of 203 because you really multiplied 713 by 200.

$$\begin{array}{r} \text{A} \\ 713 \\ \underline{203} \\ 2139 \\ 000 \\ \underline{1426} \\ 144739 \end{array} \qquad \begin{array}{r} \text{B} \\ 713 \\ \underline{203} \\ 2139 \\ \underline{1426} \\ 144739 \end{array}$$

3. One way to check multiplication is to go over your work. Another way is to change the places of the multiplicand and the multiplier and multiply again, as shown at the right.

Check

$$\begin{array}{r} 58 \\ \underline{34} \\ 232 \\ \underline{174} \\ 1972 \end{array} \qquad \begin{array}{r} 34 \\ \underline{58} \\ 272 \\ \underline{170} \\ 1972 \end{array}$$

Multiply. **Check as shown in 3 ex. 3 above:** Stress.

4.	70	307	462	400	509	386
	35	241	706	189	362	508
	2450	73,987	326,172	75,600	184,258	196,088
5.	90	83	243	700	206	598
	73	60	204	579	135	107
	6570	4980	49,572	405,300	27,810	63,986

More Practice. See ④ on page 311.

Be sure pupils understand placement of partial products when zero is dropped. Stress that carried number is added after next multiplication. Emphasize place value of multipliers and order of multiplication.

Problems Present word problems involving addition, subtraction, multiplication.

1. Mr. Brown bought a new garden tractor for $342.50. To use with his tractor he also bought a plow for $45.95, a power sprayer for $108.50, and a snow blower for $202.75. How much did he pay in all? $ 699.70
2. Fred has been saving the money he earns in order to buy a new bicycle that costs $45.00. He has saved $31.85. How much more must Fred save in order to buy the bicycle? $ 13.15
3. Jane took a reading test and found she could read 196 words per minute. At that rate, how many words could she read in 12 min.? 2352
4. The airline distance from Boston to St. Louis is 1038 mi. and from Boston to Salt Lake City is 2099 mi. How much farther is it to Salt Lake City than to St. Louis? 1061 mi.
5. During one week Jim and his father sold 60 doz. ears of sweet corn from their garden at $.45 a dozen. How much did they get for the corn? $ 27.00
6. Betty will visit her grandparents during Christmas vacation. Her railroad ticket will cost $6.47. When Betty buys her ticket, how much change should she get from a 10-dollar bill? $ 3.53
7. Bay City has 5 grade schools with the following numbers of pupils: 219; 342; 189; 247; 264. Find the total number of grade school pupils in Bay City. 1261

Group pupils who had mistakes to help them analyze causes of errors. Try to determine if basic facts, adding by endings, carrying, thought patterns, and so on, are causes of difficulty.

Roman Numerals

1. Roman numerals are often used today to number the chapters in books. They are also used to number the different books in a set of books. Tell some other places where Roman numerals are used.

2. Seven letters are used for symbols in the Roman system of writing numbers. The letters have these values:

I	V	X	L	C	D	M
1	5	10	50	100	500	1000

3. The following rules tell you how to find the value of a number written in Roman numerals: `Emphasize.`

(1) If the letters are the same or if they decrease in value from left to right, add their values:

XXIII = 23 CXXVI = 126 DCC = 700 LXXXI = 81

(2) If a letter is on the left of a letter with a larger value, subtract the smaller from the larger:

IV = 4 IX = 9 XC = 90 CM = 900

XXIV = 24 CXL = 140 MXC = 1090 XXXIX = 39

IV may also be written as IIII. CM may also be written as DCCCC.

Read these numbers:

4. LXIV 64 XXVI 26 XCIV 94 MDCI 1601 MCCCL 1350

5. XLVI 46 LXIX 69 XLIV 44 MCMV 1905 MCMLX 1960

6. CCV 205 MCM 1900 CMLI 951 MCCC 1300 MMXIX 2019

7. CXII 112 MCC 1200 CDXI 411 CDLX 460 LXXIX 79

Write these numbers, using Roman numerals:

8. 39 XXXIX 47 XLVII 325 CCCXXV 1892 MDCCCXCII 1958 MCMLVIII 1710 MDCCX

9. 56 LVI 94 XCIV 571 DLXXI 1066 MLXVI 1549 MDXLIX 1877 MDCCCLXXVII

10. 83 LXXXIII 68 LXVIII 214 CCXIV 1450 MCDL 1620 MDCXX 1962 MCMLXII

`Have pupils make up sentences or puzzles using Roman numerals, for example, "We traveled CXII miles to go to the fair." Have partners translate them into Arabic numerals.`

If You Forget the 4's, 6's, or 8's

Sometimes you forget the answer to a multiplication fact. If the multiplication fact has a 4, or a 6, or an 8 as one of its numbers, you can easily get the answer as shown below.

1. If you forget the answer to 4×9, take $\frac{1}{2}$ of 4, which is 2. Then find the answer for 2×9 and double it. Think, "$2 \times 9 = 18$, $2 \times 18 = 36$. So $4 \times 9 = 36$." You see that $4 \times 9 = (2 \times 2) \times 9 = 2 \times (2 \times 9)$.

2. Show how to get the answer if you forget 4×7;(1) 5×4;(2) 9×4.(3) In each case begin by taking $\frac{1}{2}$ of 4. (1) 2x7=14, 2x14=28, so 4x7=28; (2) 2x5=10, 2x10=20, so 5x4=20; (3) 2x9=18, 2x18=36, so 9x4=36

3. If you forget the answer to 6×7, take $\frac{1}{2}$ of 6, which is 3. Then find the answer for 3×7 and double it. Think, "$3 \times 7 = 21$, $2 \times 21 = 42$. So $6 \times 7 = 42$."

4. Show how to get the answer if you forget 6×5; 6×9; 7×6; 3×6. In each case begin by taking $\frac{1}{2}$ of 6. See G–15.

5. If you forget the answer to 8×7, take $\frac{1}{2}$ of 8, which is 4. Then find the answer for 4×7 and double it. Think, "$4 \times 7 = 28$, $2 \times 28 = 56$. So $8 \times 7 = 56$." You see that $8 \times 7 = (2 \times 4) \times 7 = 2 \times (4 \times 7)$.

6. Suppose you forget the answer to 6×8. This fact has both a 6 and an 8. In this case take $\frac{1}{2}$ of **one** of the numbers. If you take $\frac{1}{2}$ of 6, you get 3. Then find 3×8, which is 24. Double 24, which is 48. So $6 \times 8 = 48$. You can also get the same answer by taking $\frac{1}{2}$ of 8, which is 4. Then $6 \times 4 = 24$, $2 \times 24 = 48$. So $6 \times 8 = 48$.

Suppose you forget these facts. Find the answers as shown above:

7. 8 × 5 40   4 × 8 32   8 × 6 48   6 × 4 24   8 × 9 72

8. 7 × 8 56   6 × 6 36   5 × 8 40   8 × 8 64   9 × 8 72

Main purpose of this work is to show pupil how he can find answer to forgotten fact by process of thinking instead of asking you or looking it up on chart. Give further practice like ex. 7–8.

The Mysterious 9's

Teach pupils how to remember the 9's facts in multiplication.

1. Study the 9's table at the right. When you multiply 9 by 3, you get 27. You see that the first figure of 27 is 2, which is 1 less than 3, by which you multiplied.

2. When you multiply 9 by 7, you get 63. The first figure of 63 is 6, which is 1 less than 7.

2 × 9 = 18   1 + 8 = 9
3 × 9 = 27   2 + 7 = 9
4 × 9 = 36   3 + 6 = 9
5 × 9 = 45   4 + 5 = 9
6 × 9 = 54   5 + 4 = 9
7 × 9 = 63   6 + 3 = 9
8 × 9 = 72   7 + 2 = 9
9 × 9 = 81   8 + 1 = 9

In the 9's table the first figure of each answer is 1 less than the number by which 9 is multiplied.

3. Look again at the answers in the 9's table. The first answer is 18; if you add 1 and 8, you get 9. The second answer is 27; if you add 2 and 7, you get 9. Add the figures in each of the other answers. Is the sum always 9?

If you know the first figure of an answer in the 9's table, you can get the second figure by adding enough to the first figure to make 9.

4. Suppose you forget the answer to 8 × 9. The first figure of the answer is 1 less than 8, which is 7. To get the second figure of the answer, add enough to 7 to make 9. Since 7 and 2 make 9, the second figure of the answer is 2. So 8 × 9 = 72. Try this plan on other 9's facts.

5. If you forget 9 × 6, think, "1 less than 6 is 5. 5 and 4 are 9, so the answer is 54. 9 × 6 = 54."

As on page 20, main purpose of lesson is to enable pupil to find answer to forgotten fact by process of thinking, using number relationships (see G-15). Give pupils further practice in using these relationships.

Date..........
Acc. No. 13372, 19.5.2008

Present diagnostic test of pupils' mastery of division facts.

The 90 Division Facts

This is a test on the division facts. You should be able to give all the quotients orally within the time stated by the teacher:

1.	$\begin{array}{r}2\\2\overline{)4}\end{array}$	$\begin{array}{r}0\\8\overline{)0}\end{array}$	$\begin{array}{r}1\\6\overline{)6}\end{array}$	$\begin{array}{r}6\\4\overline{)24}\end{array}$	$\begin{array}{r}2\\7\overline{)14}\end{array}$	$\begin{array}{r}8\\2\overline{)16}\end{array}$
2.	$\begin{array}{r}2\\1\overline{)2}\end{array}$	$\begin{array}{r}2\\4\overline{)8}\end{array}$	$\begin{array}{r}0\\1\overline{)0}\end{array}$	$\begin{array}{r}7\\7\overline{)49}\end{array}$	$\begin{array}{r}5\\3\overline{)15}\end{array}$	$\begin{array}{r}7\\6\overline{)42}\end{array}$
3.	$\begin{array}{r}0\\3\overline{)0}\end{array}$	$\begin{array}{r}9\\1\overline{)9}\end{array}$	$\begin{array}{r}8\\6\overline{)48}\end{array}$	$\begin{array}{r}4\\5\overline{)20}\end{array}$	$\begin{array}{r}6\\9\overline{)54}\end{array}$	$\begin{array}{r}5\\4\overline{)20}\end{array}$
4.	$\begin{array}{r}4\\2\overline{)8}\end{array}$	$\begin{array}{r}1\\4\overline{)4}\end{array}$	$\begin{array}{r}9\\7\overline{)63}\end{array}$	$\begin{array}{r}6\\3\overline{)18}\end{array}$	$\begin{array}{r}6\\6\overline{)36}\end{array}$	$\begin{array}{r}3\\9\overline{)27}\end{array}$
5.	$\begin{array}{r}3\\3\overline{)9}\end{array}$	$\begin{array}{r}8\\1\overline{)8}\end{array}$	$\begin{array}{r}4\\9\overline{)36}\end{array}$	$\begin{array}{r}7\\4\overline{)28}\end{array}$	$\begin{array}{r}3\\7\overline{)21}\end{array}$	$\begin{array}{r}5\\6\overline{)30}\end{array}$
6.	$\begin{array}{r}3\\1\overline{)3}\end{array}$	$\begin{array}{r}3\\2\overline{)6}\end{array}$	$\begin{array}{r}7\\5\overline{)35}\end{array}$	$\begin{array}{r}4\\7\overline{)28}\end{array}$	$\begin{array}{r}8\\9\overline{)72}\end{array}$	$\begin{array}{r}8\\3\overline{)24}\end{array}$
7.	$\begin{array}{r}0\\5\overline{)0}\end{array}$	$\begin{array}{r}1\\5\overline{)5}\end{array}$	$\begin{array}{r}2\\8\overline{)16}\end{array}$	$\begin{array}{r}6\\5\overline{)30}\end{array}$	$\begin{array}{r}9\\9\overline{)81}\end{array}$	$\begin{array}{r}4\\3\overline{)12}\end{array}$
8.	$\begin{array}{r}1\\9\overline{)9}\end{array}$	$\begin{array}{r}0\\4\overline{)0}\end{array}$	$\begin{array}{r}9\\2\overline{)18}\end{array}$	$\begin{array}{r}6\\7\overline{)42}\end{array}$	$\begin{array}{r}5\\8\overline{)40}\end{array}$	$\begin{array}{r}4\\4\overline{)16}\end{array}$
9.	$\begin{array}{r}5\\1\overline{)5}\end{array}$	$\begin{array}{r}0\\2\overline{)0}\end{array}$	$\begin{array}{r}5\\5\overline{)25}\end{array}$	$\begin{array}{r}8\\8\overline{)64}\end{array}$	$\begin{array}{r}5\\2\overline{)10}\end{array}$	$\begin{array}{r}3\\5\overline{)15}\end{array}$
10.	$\begin{array}{r}0\\6\overline{)0}\end{array}$	$\begin{array}{r}1\\3\overline{)3}\end{array}$	$\begin{array}{r}6\\2\overline{)12}\end{array}$	$\begin{array}{r}9\\8\overline{)72}\end{array}$	$\begin{array}{r}4\\6\overline{)24}\end{array}$	$\begin{array}{r}4\\8\overline{)32}\end{array}$
11.	$\begin{array}{r}2\\3\overline{)6}\end{array}$	$\begin{array}{r}0\\7\overline{)0}\end{array}$	$\begin{array}{r}6\\8\overline{)48}\end{array}$	$\begin{array}{r}8\\5\overline{)40}\end{array}$	$\begin{array}{r}2\\9\overline{)18}\end{array}$	$\begin{array}{r}7\\2\overline{)14}\end{array}$
12.	$\begin{array}{r}1\\2\overline{)2}\end{array}$	$\begin{array}{r}6\\1\overline{)6}\end{array}$	$\begin{array}{r}5\\7\overline{)35}\end{array}$	$\begin{array}{r}7\\3\overline{)21}\end{array}$	$\begin{array}{r}3\\8\overline{)24}\end{array}$	$\begin{array}{r}9\\6\overline{)54}\end{array}$
13.	$\begin{array}{r}7\\1\overline{)7}\end{array}$	$\begin{array}{r}0\\9\overline{)0}\end{array}$	$\begin{array}{r}7\\9\overline{)63}\end{array}$	$\begin{array}{r}9\\3\overline{)27}\end{array}$	$\begin{array}{r}7\\8\overline{)56}\end{array}$	$\begin{array}{r}2\\5\overline{)10}\end{array}$
14.	$\begin{array}{r}1\\7\overline{)7}\end{array}$	$\begin{array}{r}1\\8\overline{)8}\end{array}$	$\begin{array}{r}8\\4\overline{)32}\end{array}$	$\begin{array}{r}3\\6\overline{)18}\end{array}$	$\begin{array}{r}3\\4\overline{)12}\end{array}$	$\begin{array}{r}8\\7\overline{)56}\end{array}$
15.	$\begin{array}{r}4\\1\overline{)4}\end{array}$	$\begin{array}{r}1\\1\overline{)1}\end{array}$	$\begin{array}{r}9\\5\overline{)45}\end{array}$	$\begin{array}{r}2\\6\overline{)12}\end{array}$	$\begin{array}{r}5\\9\overline{)45}\end{array}$	$\begin{array}{r}9\\4\overline{)36}\end{array}$

To the Teacher. See the suggestions on page 327 for giving this diagnostic test on the fundamental division facts.

Flash cards may be used for this test (see suggestions for page 6 on G-10). Note that mastery of division facts depends on mastery of multiplication facts. Conduct drill on related multiplication and division facts for pupils who have not achieved automatic response.

Reteach division as the inverse operation of multiplication (ex. 1, 2). Review the identity element of division(ex. 4).

Division Is Related to Multiplication

1. If you forget the answer to the division fact $8\overline{)56}$, ask yourself this question: "How many 8's make 56?" If you remember the multiplication facts well, you know that seven 8's make 56. This tells you that $8\overline{)56}$ is 7.

2. You can use division to find an unknown factor of a number. If you know that one of two factors which have the product 48 is 6, then the division fact $6\overline{)48}$ tells you the other factor is 8. Find the missing factor:

3 × .7. = 21   .9. × 8 = 72   5 × .9. = 45   .8. × 4 = 32

3. When 0 is divided by any other number the quotient is 0. 0 ÷ 6 = 0. Why? **If *n* stands for any number other than *0*, then *0 ÷ n = 0*.** Tell what number goes in each space:

0 ÷ 4 = .0.   0 ÷ 7 = .0.   0 ÷ 2 = .0.   0 ÷ 9 = .0.

4. It is easy to divide by 1. **If *n* stands for any number, *n ÷ 1 = n*.** What number goes in each space?

4 ÷ 1 = .4.   6 ÷ 1 = .6.   8 ÷ 1 = .8.   3 ÷ 1 = .3.

5. When any number other than 0 is divided by itself the quotient is 1. 5 ÷ 5 = 1. **If *n* stands for any number other than 0, then *n ÷ n = 1*.** What number goes in each space?

3 ÷ 3 = .1.   9 ÷ 9 = .1.   4 ÷ 4 = .1.   6 ÷ 6 = .1.

6. The division fact $4\overline{)12}$ is called an **even** division fact because 4 divides 12 **exactly** or **evenly**. The division fact $4\overline{)14}$ is an **uneven** division fact because 4 does not divide 14 exactly; in this case the answer is 3 with 2 left over. Is 4 a factor of 12? yes Is 4 a factor of 14? no Emphasize difference between even and uneven facts.

Divide mentally. Give only the quotient and the amount left over. For example, in $2\overline{)7}$, say only "3 and 1 over."*

7. $\overset{3R1}{2\overline{)7}}$ $\overset{7R1}{4\overline{)29}}$ $\overset{5R1}{2\overline{)11}}$ $\overset{5R1}{3\overline{)16}}$ $\overset{4R2}{5\overline{)22}}$ $\overset{6R1}{4\overline{)25}}$ $\overset{4R1}{3\overline{)13}}$

8. $\overset{1R2}{7\overline{)9}}$ $\overset{6R1}{3\overline{)19}}$ $\overset{4R3}{6\overline{)27}}$ $\overset{8R1}{4\overline{)33}}$ $\overset{6R1}{2\overline{)13}}$ $\overset{7R4}{7\overline{)53}}$ $\overset{4R3}{4\overline{)19}}$

More Practice. See ⑤ on page 311. Use to reinforce skill.

*For convenience here, answers are given as "3 R 1," instead of "3 and 1 over." Pupils who have difficulty with uneven facts should be reminded of "helping number" (next smaller number that can be divided evenly).

Review vocabulary for division, and long and short forms (pages 24–25). In discussing ex. 1 emphasize reason for placement of 4 in quotient over 8 in dividend (dividing 28 tens gives tens).

Dividing Larger Numbers

Ask why remainder must be smaller than divisor.

1. Problem The sixth grade has made 285 Christmas cards to sell at the school fair. If the cards are put into packages of 6 cards each, how many packages will there be? 47 and 3 over

$$\begin{array}{rrl} & 47 & \text{Quotient}\\ \text{Divisor } 6 & \overline{)285} & \text{Dividend}\\ & \underline{24} & \\ & 45 & \\ & \underline{42} & \\ & 3 & \text{Remainder} \end{array}$$

Explanation Divide 285 by 6 like this: First divide 28 tens by 6. Think, "28 ÷ 6 = 4 with 4 over." Write 4 over the 8 of 28. Multiply 6 by 4, which gives 24. Subtract 24 from 28 and you have 4 left over. Bring down 5. Now divide 45 ones by 6. Think, "45 ÷ 6 = 7 with 3 over." Write 7 over 5. Multiply 6 by 7, which gives 42. Subtract 42 from 45. You have 3 left over. The answer is 47 with 3 over.

Explain "why."→

Check

$$\begin{array}{r} 47\\ \underline{6}\\ 282\\ \underline{3}\\ 285 \end{array}$$

In the work above, 6 is the **divisor,** 285 is the **dividend,** 47 is the **quotient,** and 3 is the **remainder.**

To check division, multiply the quotient by the divisor and then add the remainder. The result should be the same as the dividend.

Add division terms to vocabulary chart (page 8).

Divide and check:

2. $\begin{array}{r}53\text{R}3\\6\overline{)321}\end{array}$ $\begin{array}{r}87\text{R}1\\4\overline{)349}\end{array}$ $\begin{array}{r}1797\\2\overline{)3594}\end{array}$ $\begin{array}{r}939\\7\overline{)6573}\end{array}$ $\begin{array}{r}2739\\4\overline{)10956}\end{array}$

3. $\begin{array}{r}47\text{R}5\\8\overline{)381}\end{array}$ $\begin{array}{r}26\text{R}4\\9\overline{)238}\end{array}$ $\begin{array}{r}896\\5\overline{)4480}\end{array}$ $\begin{array}{r}1378\\3\overline{)4134}\end{array}$ $\begin{array}{r}2784\\6\overline{)16704}\end{array}$

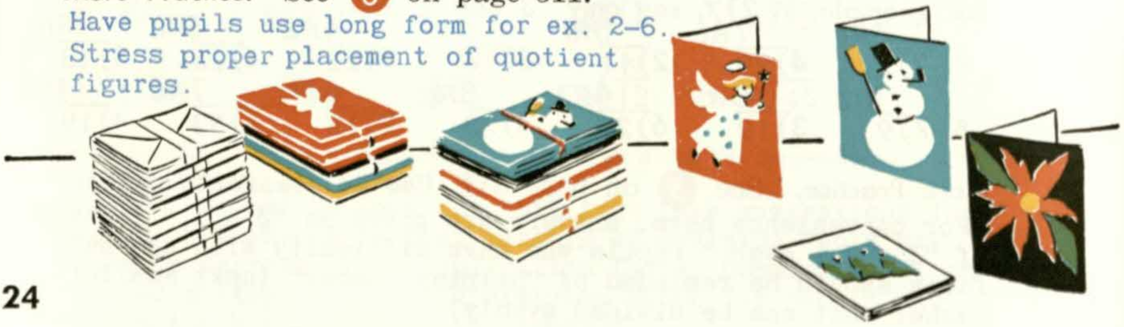
4. $\begin{array}{r}137\text{R}3\\6\overline{)825}\end{array}$ $\begin{array}{r}463\text{R}1\\2\overline{)927}\end{array}$ $\begin{array}{r}386\text{R}3\\7\overline{)2705}\end{array}$ $\begin{array}{r}1027\text{R}2\\9\overline{)9245}\end{array}$ $\begin{array}{r}2963\text{R}1\\5\overline{)14816}\end{array}$

5. $\begin{array}{r}265\\3\overline{)795}\end{array}$ $\begin{array}{r}219\text{R}2\\4\overline{)878}\end{array}$ $\begin{array}{r}1238\text{R}5\\8\overline{)9909}\end{array}$ $\begin{array}{r}1429\\6\overline{)8574}\end{array}$ $\begin{array}{r}6253\\9\overline{)56277}\end{array}$

6. $\begin{array}{r}70\text{R}7\\8\overline{)567}\end{array}$ $\begin{array}{r}58\text{R}3\\9\overline{)525}\end{array}$ $\begin{array}{r}3855\\2\overline{)7710}\end{array}$ $\begin{array}{r}654\\5\overline{)3270}\end{array}$ $\begin{array}{r}5076\\4\overline{)20304}\end{array}$

More Practice. See ⑥ on page 311.

Have pupils use long form for ex. 2–6. Stress proper placement of quotient figures.



In ex. 1 be sure pupils understand that the 1 left over is 1 ten, which can be exchanged for 10 ones and added to 9 ones to make 19 ones.

Dividing the Short Way

1. In division the work can be done by writing all the steps as shown below at A. The work may also be done a shorter way as shown at B. In the short way all the steps are done mentally and only the answer is written. When doing this example the short way, think, "13 divided by 3 is 4 with 1 over." Write 4 in the quotient over the 3 of 13. Think of the 1 left over as going before the 9 in the dividend, making 19. Then think, "19 divided by 3 is 6 with 1 over." Write 6 in the quotient and show the remainder by writing R1 at the right of the quotient.

A

$$\begin{array}{r} 46 \\ 3\overline{)139} \\ \underline{12} \\ 19 \\ \underline{18} \\ 1 \end{array}$$

B

$$\begin{array}{r} 46\,\text{R1} \\ 3\overline{)139} \end{array}$$

You may divide the short way if you can get correct answers easily and quickly that way. If you have difficulty with division, use the longer way and write all the steps. You may wish to use the short way only when the divisor is 2, 3, 4, or 5.

Divide the short way. Give only the answers: Emphasize.

2. $\overset{27}{2\overline{)54}}$ $\overset{32}{3\overline{)96}}$ $\overset{32\text{R3}}{5\overline{)163}}$ $\overset{53\text{R3}}{4\overline{)215}}$ $\overset{84}{5\overline{)420}}$ $\overset{238}{2\overline{)476}}$

3. $\overset{43\text{R1}}{2\overline{)87}}$ $\overset{12\text{R1}}{4\overline{)49}}$ $\overset{41}{3\overline{)123}}$ $\overset{72\text{R2}}{4\overline{)290}}$ $\overset{408\text{R1}}{2\overline{)817}}$ $\overset{134\text{R4}}{5\overline{)674}}$

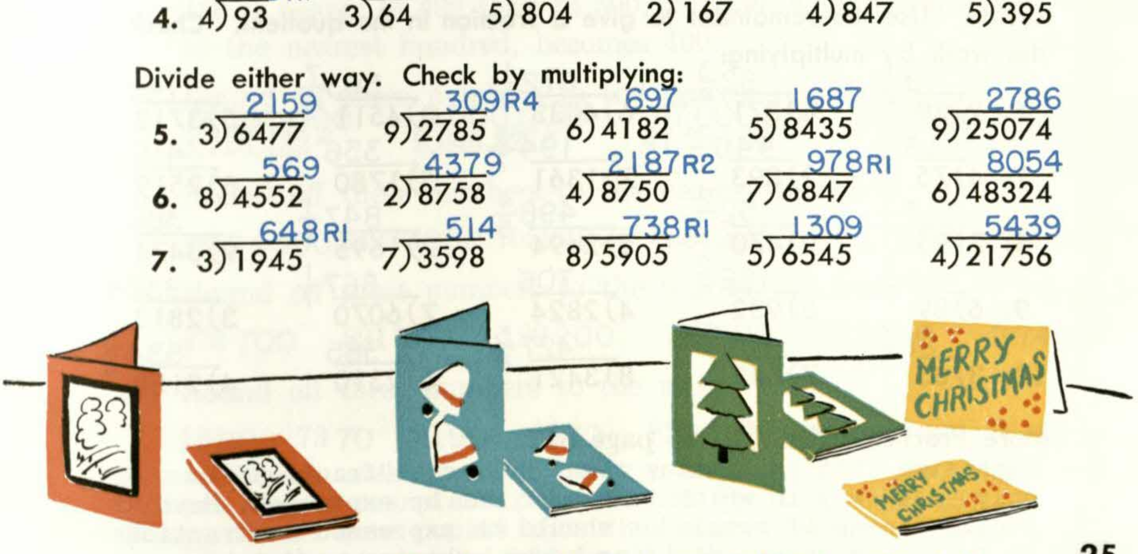
4. $\overset{23\text{R1}}{4\overline{)93}}$ $\overset{21\text{R1}}{3\overline{)64}}$ $\overset{160\text{R4}}{5\overline{)804}}$ $\overset{83\text{R1}}{2\overline{)167}}$ $\overset{211\text{R3}}{4\overline{)847}}$ $\overset{79}{5\overline{)395}}$

Divide either way. Check by multiplying:

5. $\overset{2159}{3\overline{)6477}}$ $\overset{309\text{R4}}{9\overline{)2785}}$ $\overset{697}{6\overline{)4182}}$ $\overset{1687}{5\overline{)8435}}$ $\overset{2786}{9\overline{)25074}}$

6. $\overset{569}{8\overline{)4552}}$ $\overset{4379}{2\overline{)8758}}$ $\overset{2187\text{R2}}{4\overline{)8750}}$ $\overset{978\text{R1}}{7\overline{)6847}}$ $\overset{8054}{6\overline{)48324}}$

7. $\overset{648\text{R1}}{3\overline{)1945}}$ $\overset{514}{7\overline{)3598}}$ $\overset{738\text{R1}}{8\overline{)5905}}$ $\overset{1309}{5\overline{)6545}}$ $\overset{5439}{4\overline{)21756}}$



Emphasize that all steps are done mentally in short form.

Review use of fraction in quotient.

A Fraction in the Quotient

1. **Problem** When Tom and his family were taking an automobile trip, they traveled 104 mi. in 3 hr. How many miles per hour did they average on the trip? $34\frac{2}{3}$

Explanation When you divide 104 by 3 you have 2 left over, which has not been divided. If you divide this 2 by 3, you get $\frac{2}{3}$, and the quotient is $34\frac{2}{3}$. So Tom and his family traveled $34\frac{2}{3}$ mi. per hour on the average. What does "on the average" mean?

$$\begin{array}{r}34\frac{2}{3}\\3\overline{)104}\end{array}$$

When you have a remainder in division, you can divide it by the divisor, getting a fraction. This fraction is a part of the quotient and is written as shown above.

2. In division problems it is not always sensible to divide the remainder to make a fraction in the quotient. In solving problems you must decide whether the remainder should be left as a remainder or used to give a fraction in the quotient. Emphasize.

3. Helen wishes to divide 7 yd. of ribbon into 2 equal pieces. How many yards will there be in each piece? $3\frac{1}{2}$

4. Miss Brown wants to divide the 34 pupils in her room into 3 equal groups. How many will there be in each group? 11 pupils and 1 over

5. If 1 ft. of wire costs 4¢, how many feet of this wire can be purchased for 25¢? $6\frac{1}{4}$

Divide. Use the remainder to give a fraction in the quotient. Check the work by multiplying:

6.	$\begin{array}{r}19\frac{1}{2}\\2\overline{)39}\end{array}$	$\begin{array}{r}92\frac{3}{4}\\4\overline{)371}\end{array}$	$\begin{array}{r}672\frac{1}{6}\\6\overline{)4033}\end{array}$	$\begin{array}{r}563\frac{7}{8}\\8\overline{)4511}\end{array}$	$\begin{array}{r}742\frac{2}{5}\\5\overline{)3712}\end{array}$
7.	$\begin{array}{r}18\frac{3}{4}\\4\overline{)75}\end{array}$	$\begin{array}{r}446\frac{1}{2}\\2\overline{)893}\end{array}$	$\begin{array}{r}194\frac{3}{7}\\7\overline{)1361}\end{array}$	$\begin{array}{r}356\\5\overline{)1780}\end{array}$	$\begin{array}{r}419\frac{5}{6}\\6\overline{)2519}\end{array}$
8.	$\begin{array}{r}13\frac{4}{7}\\7\overline{)95}\end{array}$	$\begin{array}{r}52\frac{2}{9}\\9\overline{)470}\end{array}$	$\begin{array}{r}498\frac{4}{5}\\5\overline{)2494}\end{array}$	$\begin{array}{r}847\frac{1}{2}\\2\overline{)1695}\end{array}$	$\begin{array}{r}386\\9\overline{)3474}\end{array}$
9.	$\begin{array}{r}14\frac{5}{6}\\6\overline{)89}\end{array}$	$\begin{array}{r}186\frac{2}{5}\\5\overline{)932}\end{array}$	$\begin{array}{r}706\\4\overline{)2824}\end{array}$	$\begin{array}{r}867\frac{1}{7}\\7\overline{)6070}\end{array}$	$\begin{array}{r}937\frac{2}{3}\\3\overline{)2813}\end{array}$
10.	$\begin{array}{r}27\frac{2}{3}\\3\overline{)83}\end{array}$	$\begin{array}{r}91\frac{5}{7}\\7\overline{)642}\end{array}$	$\begin{array}{r}427\frac{5}{8}\\8\overline{)3421}\end{array}$	$\begin{array}{r}385\\6\overline{)2310}\end{array}$	$\begin{array}{r}534\frac{3}{4}\\4\overline{)2139}\end{array}$

More Practice. See ⑦ on page 312.

Emphasize that expressing remainder as a "fraction" is only "one" way in which remainder can be expressed. Have pupils decide if remainder should be expressed as fractions in following cases: dividing books, sharing sandwiches, and so on.

Round Numbers

1. Andy read in a newspaper that each year 3,000,000,000 lb. of candy are produced in the United States. Andy's father told him that this number is a **round number** and that the exact number of pounds produced last year might have been 2,839,476,285 lb.

A number like 2,839,476,285 is difficult to read, so it is more useful to say that the candy production in the United States last year reached **about** 3 billion pounds. When you say that 2,839,476,285 is about 3,000,000,000, you are rounding off 2,839,476,285 to the nearest billion.

2. The next billion below 3 billion is 2 billion. You see that 2,839,476,285 is much closer to 3 billion than it is to 2 billion; for this reason you say that the number of pounds was **about** 3 billion. If the number had been 2,417,063,928, you could call it about 2 billion since 2,417,063,928 is closer to 2 billion than to 3 billion.

3. The number 8271 is nearer to 8000 than it is to 9000. When you **round off** 8271 to the nearest thousand, the result is 8000. Round off 6740 to the nearest thousand. The number 436 is nearer to 400 than 500. So 436, when rounded off to the nearest hundred, becomes 400.

4. Round off these numbers to the nearest million:

8,716,432 ← 9,000,000 9,045,327 ← 9,000,000 47,286,000 ← 47,000,000 14,857,295 ← 15,000,000

5. Round off these numbers to the nearest thousand:

3816 4000 9493 9000 7059 7000 8684 9000 6667 7000 5275 5000

6. Round off these numbers to the nearest hundred:

670 700 521 500 189 200 769 800 919 900 407 400

7. Round off these numbers to the nearest ten:

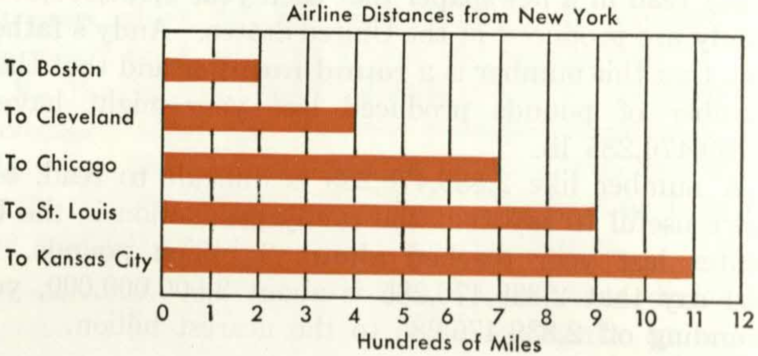
18 20 73 70 91 90 66 70 82 80 49 50 37 40 54 50

First discuss uses of round numbers in everyday life. Then do some simple examples first (to nearest ten, hundred, thousand). Be sure pupils know that number midway between two thousands is rounded off to next higher thousand.

Reteach reading and construction of bar graphs. Present application of round numbers.

Bar Graphs

1. Study the bar graph below. The numbers at the bottom of the graph show distances in miles and are called the **scale.** These numbers stand for **hundreds** of miles. You see that 2 stands for 200 mi. What distance does 6 stand for? 600 mi.



2. The first bar above shows the approximate airline distance from New York to Boston. About how many miles is it? 200

3. What is the approximate distance from New York to Chicago? 700 mi. to Kansas City? 1100 mi. to St. Louis? 900 mi. to Cleveland? 400 mi.

4. The actual airline distance from New York to Chicago is 713 mi. Before the graph was drawn this number was rounded off to the nearest hundred. Therefore this bar extends from 0 to 7 and shows that the approximate distance from New York to Chicago is 700 mi.

5. The actual distances from New York to the other cities are as follows: Boston, 188 mi.; Cleveland, 405 mi.; St. Louis, 875 mi.; Kansas City, 1097 mi. Round off each of these numbers to the nearest hundred. Then see if the bars in the above graph are the right length.

6. The airline distances from Chicago to these cities are as follows: Cleveland, 308 mi.; Kansas City, 414 mi.; Washington, 597 mi.; Philadelphia, 666 mi.; Salt Lake City, 1260 mi. Draw a bar graph to show these distances. See G-19. Before drawing the graph round off the numbers to the nearest hundred. Remind pupils of other ways of drawing data (line and picture graphs).

In discussing bar graphs point out that scale selected depends on space available for graph and upon range in numbers to be represented. Also emphasize that bar graphs are drawn mainly to give quick comparisons.

Review division with 2-figure divisors where Rule I is used to estimate quotient figures (pages 29–31).

Two-Figure Divisors

1. **Problem** An airplane pilot flew 7290 mi. in 31 hr. How many miles per hour, on the average, did he fly? 235

Explanation You must divide 7290 by 31.

The first partial dividend is 72. To estimate the first quotient figure, **divide** 7 by 3. This gives 2, which you write over the 2 of 72. **Multiply** 31 by 2, which gives 62. **Subtract** 62 from 72, which gives a remainder of 10. **Compare** the remainder with the divisor. Since 10 is less than 31, the quotient figure 2 is right. **The remainder must always be less than the divisor.** **Bring down** 9, which makes the next partial dividend 109. You repeat these steps to find the other two quotient figures.

Emphasize

$$\begin{array}{r} 235 \\ 31\overline{)7290} \\ \underline{62} \\ 109 \\ \underline{93} \\ 160 \\ \underline{155} \\ 5 \end{array}$$

Check

$$\begin{array}{r} 235 \\ \underline{31} \\ 235 \\ \underline{705} \\ 7285 \\ \underline{5} \\ 7290 \end{array}$$

The quotient is 235 with a remainder of 5. The pilot flew about 235 miles per hour, on the average.

To check the work multiply 235 by 31 and add the remainder 5. The result should equal the dividend 7290.

Emphasize. ↓

When a two-figure divisor ends in 1, 2, 3, 4, or 5, divide by the first figure of the divisor to estimate each figure of the quotient.

Divide and check: Stress checking.

2.	$\begin{array}{r}38\\42\overline{)1596}\end{array}$	$\begin{array}{r}36\text{R}15\\52\overline{)1887}\end{array}$	$\begin{array}{r}329\text{R}10\\81\overline{)26659}\end{array}$	$\begin{array}{r}724\text{R}30\\54\overline{)39126}\end{array}$
3.	$\begin{array}{r}46\\32\overline{)1472}\end{array}$	$\begin{array}{r}26\text{R}33\\73\overline{)1931}\end{array}$	$\begin{array}{r}374\\93\overline{)34782}\end{array}$	$\begin{array}{r}627\text{R}5\\22\overline{)13799}\end{array}$
4.	$\begin{array}{r}57\text{R}4\\62\overline{)3538}\end{array}$	$\begin{array}{r}82\text{R}28\\43\overline{)3554}\end{array}$	$\begin{array}{r}482\text{R}23\\71\overline{)34245}\end{array}$	$\begin{array}{r}427\text{R}29\\91\overline{)38886}\end{array}$
5.	$\begin{array}{r}62\text{R}6\\31\overline{)1928}\end{array}$	$\begin{array}{r}57\text{R}18\\92\overline{)5262}\end{array}$	$\begin{array}{r}725\text{R}7\\41\overline{)29732}\end{array}$	$\begin{array}{r}573\\72\overline{)41256}\end{array}$

More Practice. See ⑧ on page 312.

Be sure to discuss ex. 1 carefully with pupils, reminding them of the 5 steps used in finding "each" quotient figure. Emphasize importance of comparison step. See G-4, 5, and 19 for further discussion of division process.

Correcting Quotient Figures

1. Problem The school lunchroom served 1708 lunches during the 23 school days in March. How many lunches were served on the average each school day in March? 74

Explanation You divide 17 by 2 to estimate the first quotient figure, getting 8. When you multiply 23 by 8 you get 184, which is too large to be subtracted from 170. Try 7, which is one less than 8. When you multiply 23 by 7 you get 161, which can be subtracted from 170. Is the remainder less than the divisor? Bring down 8, which gives 98 as the next partial dividend. When you divide 9 by 2 you get 4 as the next quotient figure. Why is 4 right?

$$\begin{array}{r} 8 \\ 23\overline{)1708} \\ \underline{184} \end{array} \qquad \begin{array}{r} 74 \\ 23\overline{)1708} \\ \underline{161} \\ 98 \\ \underline{92} \\ 6 \end{array}$$

The quotient is 74 with a remainder of 6. The school lunchroom served about 74 lunches per day during March.

2. Problem Divide 1807 by 24. 75R7

Explanation When you divide 18 by 2 to estimate the first quotient figure, you get 9. This figure is too large since 9 × 24 is larger than 180. When you try 8 you find that it also is too large. Why? Why is 7 right? Explain how the second quotient figure is found.

$$\begin{array}{r} 75 \\ 24\overline{)1807} \\ \underline{168} \\ 127 \\ \underline{120} \\ 7 \end{array}$$

When the quotient figure is too large, try the next smaller figure. Emphasize.

Divide and check:

3. $\begin{array}{r}58R24\\32\overline{)1880}\end{array}$ $\begin{array}{r}67R70\\93\overline{)6301}\end{array}$ $\begin{array}{r}67R59\\63\overline{)4280}\end{array}$ $\begin{array}{r}537R41\\53\overline{)28502}\end{array}$

4. $\begin{array}{r}69R17\\23\overline{)1604}\end{array}$ $\begin{array}{r}62R60\\62\overline{)3904}\end{array}$ $\begin{array}{r}39R31\\53\overline{)2098}\end{array}$ $\begin{array}{r}792R77\\83\overline{)65813}\end{array}$

5. $\begin{array}{r}74R38\\43\overline{)3220}\end{array}$ $\begin{array}{r}79R16\\34\overline{)2702}\end{array}$ $\begin{array}{r}37R50\\54\overline{)2048}\end{array}$ $\begin{array}{r}295R58\\62\overline{)18348}\end{array}$

6. $\begin{array}{r}57R19\\32\overline{)1843}\end{array}$ $\begin{array}{r}78R15\\25\overline{)1965}\end{array}$ $\begin{array}{r}57R18\\21\overline{)1215}\end{array}$ $\begin{array}{r}827R12\\44\overline{)36400}\end{array}$

More Practice. See ⑨ on page 312. Use for individual pupil assistance.

Let different pupils explain their work for ex. 3–6 at blackboard. Be sure they explain why quotient figures need to be corrected. Stress importance of checking each example.

Problems and Practice

1. A streamlined train makes a trip of 1254 mi. in 22 hr. How many miles per hour does it average? 57

2. Each coach of the train has seats for 54 passengers. How many coaches will be needed for 800 passengers if each one is to have a seat? 15

3. Last summer Mr. Field drove his family 4070 mi. in 22 da. How many miles on the average did he drive a day? 185

4. In one year Mr. Field drove his car 17,836 mi. What was the average number of miles he drove per week? 343

Divide and check. Use the rule on page 29 to find the quotient figures:

5.	$\overset{163}{51\overline{)8313}}$	$\overset{216}{24\overline{)5184}}$	$\overset{328\text{R}7}{72\overline{)23623}}$	$\overset{563\text{R}23}{53\overline{)29862}}$
6.	$\overset{263}{34\overline{)8942}}$	$\overset{65\text{R}27}{62\overline{)4057}}$	$\overset{973}{33\overline{)32109}}$	$\overset{282}{64\overline{)18048}}$
7.	$\overset{92}{73\overline{)6716}}$	$\overset{98}{92\overline{)9016}}$	$\overset{621}{60\overline{)37260}}$	$\overset{1326}{42\overline{)55692}}$
8.	$\overset{366}{25\overline{)9150}}$	$\overset{215}{32\overline{)6880}}$	$\overset{289\text{R}17}{55\overline{)15912}}$	$\overset{718}{71\overline{)50978}}$
9.	$\overset{421\text{R}12}{23\overline{)9695}}$	$\overset{128}{61\overline{)7808}}$	$\overset{833}{52\overline{)43316}}$	$\overset{463\text{R}11}{45\overline{)20846}}$
10.	$\overset{96}{75\overline{)7200}}$	$\overset{95\text{R}51}{83\overline{)7936}}$	$\overset{716\text{R}17}{40\overline{)28657}}$	$\overset{367}{54\overline{)19818}}$
11.	$\overset{322\text{R}16}{31\overline{)9998}}$	$\overset{47}{65\overline{)3055}}$	$\overset{373}{74\overline{)27602}}$	$\overset{419\text{R}32}{85\overline{)35647}}$

Do ex. 1-4 orally with pupils. Then have them do ex. 5-11 independently. Observe them as they work and encourage pupils who are having difficulty to do computations aloud to check their thinking. Some pupils may need drill on facts.

Review division with 2-figure divisors where Rule II (see G-20, 21) is used (pages 32-34).

More Two-Figure Divisors

1. Problem Last fall 29 Boy Scouts collected 15,291 lb. of old newspapers for the used paper drive. How many pounds on the average did each Boy Scout collect? 527

Explanation You need to divide 15,291 by 29.

$$\begin{array}{r} 527 \\ 29\overline{)15291} \\ \underline{145} \\ 79 \\ \underline{58} \\ 211 \\ \underline{203} \\ 8 \end{array}$$

Since 29 is closer to 30 than to 20, use 3 as the trial divisor instead of 2. To estimate the first quotient figure, divide 15 by 3, which gives 5. Multiply 29 by 5, getting 145, and subtract 145 from 152. The remainder 7 is less than the divisor 29, so 5 is right. Bring down 9, making the second partial dividend 79.

By what do you divide 7 to estimate the second quotient figure? Does this give the right quotient figure? Why? Explain how to find the third quotient figure.

The quotient is 527 with a remainder of 8. Each Boy Scout collected on the average a little more than 527 lb.

Emphasize.

When a two-figure divisor ends in 6, 7, 8, or 9, divide by 1 more than the first figure of the divisor to estimate each quotient figure.

2. What do you use as the trial divisor when the divisor is 39? 4 67? 7 58? 6 46? 5 37? 4 97? 10

Divide and check:

3.	46R25 26)1221	26R23 39)1037	439R18 28)12310	294R37 49)14443
4.	54R15 37)2013	51R74 79)4103	429R30 38)16332	347R55 67)23304
5.	86R26 28)2434	47R15 38)1801	594R7 29)17233	492R25 79)38893
6.	78R25 27)2131	38R28 49)1890	846R55 57)48277	927R17 39)36170

More Practice. See ⑩ on page 313. Use for further reteaching.

Put ex. 1 on board and discuss it thoroughly with pupils. Emphasize importance of comparison step. Have different pupils explain work in ex. 3-6. Be sure pupils understand proper placement of quotient figures (place value).

Watching the Remainder

1. Problem When George's family took an automobile trip of 442 mi. they used 26 gal. of gasoline. How many miles did they travel on the average with 1 gal. of gasoline? 17

Explanation Tell how to get the first quotient figure when you divide 442 by 26.

To estimate the second quotient figure you divide 18 by 3, getting 6. Using 6 as the quotient figure, you get a remainder of 26, which is **equal** to the divisor. This shows that the quotient figure should be 7 instead of 6, since the remainder 26 will contain 26 once. The remainder must always be less than the divisor. Stress.

$$\begin{array}{r} 16 \\ 26\overline{)442} \\ \underline{26} \\ 182 \\ \underline{156} \\ 26 \end{array}$$

$$\begin{array}{r} 17 \\ 26\overline{)442} \\ \underline{26} \\ 182 \\ \underline{182} \end{array}$$

The quotient is 17. George's family traveled an average of 17 mi. on 1 gal. of gasoline.

Emphasize.

When the remainder is equal to or larger than the divisor, try the next larger figure as the quotient figure.

2. How were the quotient figures below found? Why are they wrong? Copy each example, correct the first quotient figure, and finish the work: See G-21 for corrected examples.

$$\begin{array}{r} 8 \\ 27\overline{)2501} \\ \underline{216} \\ 34 \end{array} \qquad \begin{array}{r} 6 \\ 48\overline{)3485} \\ \underline{288} \\ 60 \end{array} \qquad \begin{array}{r} 7 \\ 36\overline{)30564} \\ \underline{252} \\ 53 \end{array} \qquad \begin{array}{r} 7 \\ 26\overline{)23816} \\ \underline{182} \\ 56 \end{array}$$

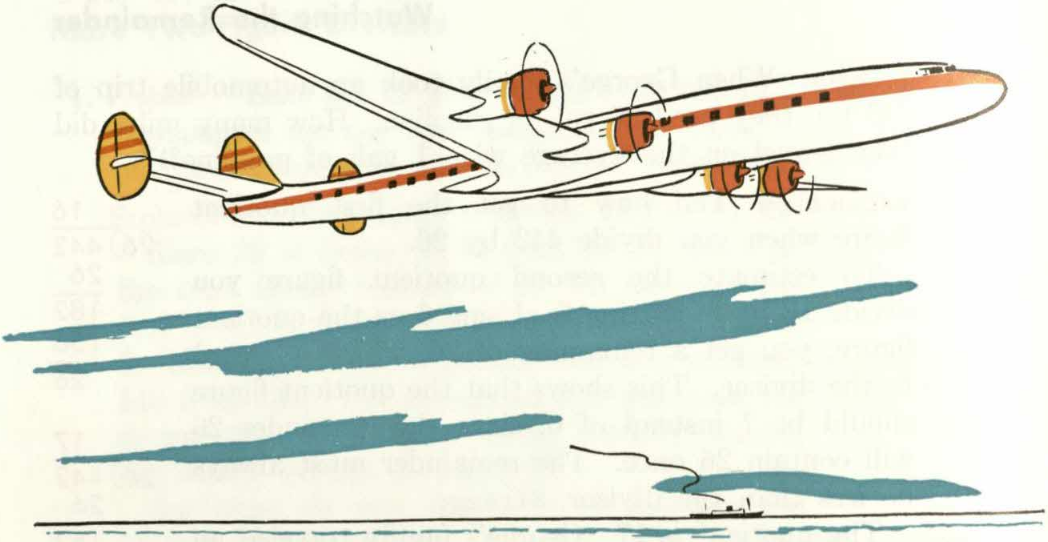
Divide and check:

$$\textbf{3.}\quad \begin{array}{r} 84 \\ 38\overline{)3192} \end{array} \qquad \begin{array}{r} 63 \\ 27\overline{)1701} \end{array} \qquad \begin{array}{r} 93 \\ 46\overline{)4278} \end{array} \qquad \begin{array}{r} 824 \\ 29\overline{)23896} \end{array}$$

$$\textbf{4.}\quad \begin{array}{r} 29\text{R}3 \\ 48\overline{)1395} \end{array} \qquad \begin{array}{r} 71 \\ 66\overline{)4686} \end{array} \qquad \begin{array}{r} 73\text{R}17 \\ 26\overline{)1915} \end{array} \qquad \begin{array}{r} 947\text{R}9 \\ 36\overline{)34101} \end{array}$$

More Practice. See ⑪ on page 313.

Do ex. 1-2 as class activity. Be sure pupils understand "why" remainder must be smaller than divisor. Stress importance of checking each example. Use "More Practice" for individual pupil assistance.



Problems and Practice

1. An airliner made an overseas flight of 7334 mi. in 19 hr. How many miles per hour did it average? 386
2. Mr. King bought 28 radios to sell in his store. He paid $975.80 in all. What was the average cost per radio? $34.85
3. Mr. King also bought 19 television sets at a total cost of $3762. What was the average cost per television set? $198
4. On a holiday 36 busses carried 1548 passengers to Ocean City. What was the average number of passengers per bus? 43

Divide. Check your work by multiplying: Stress.

5.	281 28)7868	127 48)6096	1773 29)51417	1871 37)69227
6.	523R5 19)9942	114 27)3078	786 88)69168	1234 49)60466
7.	182R21 39)7119	143 58)8294	1834R14 36)66038	351R27 59)20736
8.	217 46)9982	467 19)8873	785R42 67)52637	1123 78)87594
9.	38R55 67)2601	98 86)8428	1283 47)60301	1142 69)78798
10.	312R3 26)8115	162 57)9234	662R18 77)50992	715R11 38)27181

Have pupils do ex. 1–10 independently. If many pupils evidence difficulties, reteach accordingly. Note if 4-figure quotients cause difficulty and stress place value in reteaching.

Review zero difficulties in quotient.

Zeros in the Quotient

1. Study the examples below and tell how each quotient figure was found. Copy each dividend and divisor and divide:

$$\begin{array}{r} 730\\ 29\overline{)21170}\\ \underline{203}\\ 87\\ \underline{87}\\ 0\end{array} \qquad \begin{array}{r} 704\text{ R}24\\ 73\overline{)51416}\phantom{\text{ R}24}\\ \underline{511}\phantom{\text{ R}24}\\ 316\phantom{\text{ R}24}\\ \underline{292}\phantom{\text{ R}24}\\ 24\phantom{\text{ R}24}\end{array} \qquad \begin{array}{r} 2008\text{ R}21\\ 38\overline{)76325}\phantom{\text{ R}21}\\ \underline{76}\phantom{\text{ R}21}\\ 325\phantom{\text{ R}21}\\ \underline{304}\phantom{\text{ R}21}\\ 21\phantom{\text{ R}21}\end{array}$$

Check **Check** **Check**

$$\begin{array}{r} 730\\ \underline{29}\\ 6570\\ \underline{1460}\\ 21170\end{array} \qquad \begin{array}{r} 704\\ \underline{73}\\ 2112\\ \underline{4928}\\ 51392\\ \underline{24}\\ 51416\end{array} \qquad \begin{array}{r} 2008\\ \underline{38}\\ 16064\\ \underline{6024}\\ 76304\\ \underline{21}\\ 76325\end{array}$$

Divide and check. Write R before the remainder:

2. 76,152 ÷ 38 2004 34,046 ÷ 37 920 R6 648,818 ÷ 81 8010 R8

3. 12,896 ÷ 62 208 26,250 ÷ 25 1050 325,272 ÷ 39 8340 R12

4. 15,910 ÷ 76 209 R26 22,571 ÷ 46 490 R31 450,675 ÷ 75 6009

5. 11,880 ÷ 22 540 72,192 ÷ 24 3008 236,070 ÷ 58 4070 R10

6. 96,192 ÷ 32 3006 54,820 ÷ 27 2030 R10 103,375 ÷ 34 3040 R15

7. 36,000 ÷ 48 750 19,162 ÷ 93 206 R4 152,304 ÷ 19 8016

8. Last year Mr. Peck drove his car 20,285 mi. Find the average number of miles he drove per week. 390 R 5, or about 390

9. In the last 19 mo. Jim has earned \$381.71. What is the average amount he has earned per month? \$ 20.09

10. To make money to buy new suits for the ball team, 89 boys sold 9345 lb. of old paper. On the average, about how many pounds of paper did each boy sell? 105

In discussing ex. 1 with pupils emphasize that a figure must be put in quotient every time a figure is brought down from the dividend. In the second example in ex. 1, point out that zero is necessary to show that 31 has been divided and there are no tens.

Provide oral and written review of basic division examples.
Provide practice with factors.

Oral Practice

Divide each number by 4.(1) Divide each by 5:(2)

(1) 5 12 8 7R1 8R1 11R1 4R3 2
(2)**1.** 20 4 48 9R3 32 6R2 29 5R4 33 6R3 45 9 19 3R4 8 1R3

3R1 6R1 10R1 4R1 9R1 7 7R3 0R3
2. 13 2R3 25 5 41 8R1 17 3R2 37 7R2 28 5R3 31 6R1 3 0R3

Divide mentally:

3. $\overset{21}{5\overline{)105}}$ $\overset{42}{4\overline{)168}}$ $\overset{240}{2\overline{)480}}$ $\overset{51}{9\overline{)459}}$ $\overset{81}{7\overline{)567}}$ $\overset{91}{4\overline{)364}}$

4. $\overset{231}{3\overline{)693}}$ $\overset{70}{8\overline{)560}}$ $\overset{31}{6\overline{)186}}$ $\overset{60}{5\overline{)300}}$ $\overset{302}{3\overline{)906}}$ $\overset{341}{2\overline{)682}}$

5. $\overset{43}{4\overline{)172}}$ $\overset{98}{2\overline{)196}}$ $\overset{58}{5\overline{)290}}$ $\overset{85}{3\overline{)255}}$ $\overset{67}{2\overline{)134}}$ $\overset{75}{4\overline{)300}}$

Find the missing factor:

6. $7 \times .4. = 28$ $.3. \times 9 = 27$ $3 \times .21. = 63$ $.41. \times 2 = 84$

7. $5 \times .6. = 30$ $.9. \times 4 = 36$ $2 \times .46. = 92$ $.41. \times 4 = 164$

8. $9 \times .9. = 81$ $.9. \times 6 = 54$ $6 \times .12. = 72$ $.40. \times 5 = 200$

9. $7 \times .1. = 7$ $.48. \times 1 = 48$ $3 \times .29. = 87$ $.203. \times 4 = 812$

Written Practice

Divide and check. Use any remainder to give a fraction in the quotient:

10. 25,792 ÷ 32 806 30,258 ÷ 41 738 118,569 ÷ 26 $4560\frac{9}{26}$

11. 32,307 ÷ 85 $380\frac{7}{85}$ 35,364 ÷ 28 1263 116,181 ÷ 39 2979

12. 15,235 ÷ 18 $846\frac{7}{18}$ 33,633 ÷ 37 909 506,846 ÷ 63 $8045\frac{11}{63}$

13. 75,497 ÷ 54 $1398\frac{5}{54}$ 34,500 ÷ 46 750 231,245 ÷ 35 6607

14. 12,529 ÷ 67 187 11,995 ÷ 23 $521\frac{12}{23}$ 373,837 ÷ 89 $4200\frac{37}{89}$

15. 58,870 ÷ 29 2030 37,431 ÷ 58 $645\frac{21}{58}$ 453,546 ÷ 74 6129

16. Divide by 19: 4579 241 16,214 $853\frac{7}{19}$ 13,243 697 110,175 $5798\frac{13}{19}$

17. Divide by 25: 1128 $45\frac{3}{25}$ 15,511 $620\frac{11}{25}$ 23,450 938 104,775 4191

18. Divide by 57: 1547 $27\frac{8}{57}$ 11,725 $205\frac{40}{57}$ 84,075 1475 342,513 6009

Pupils who have difficulty with ex. 1-5 may need drill on multiplication and/or division facts. Help pupils analyze errors in ex. 10-18.

Review or reteach measures taught in preceding grades.

Using Measures

1. Last summer Bill was at camp for 2 wk. and 4 da. This summer he will go to camp for 4 wk. How many more days will Bill be at camp this summer than last? 10

2. Mrs. Hood saw two boxes of cookies in a store. One box was marked "1 lb. 2 oz." The other box of cookies was marked "10 oz." Which box held more ounces of cookies and how many ounces more did it hold? The 1lb.2oz. box held 8oz. more.

3. Mary's mother made 145 cookies and Mary sold them by the dozen. How many dozen cookies were there? 12 Were any cookies left over? 1

4. Mary sold the cookies at 40¢ a dozen. How much did she get for $\frac{1}{2}$ doz. cookies? 20¢ for $\frac{3}{4}$ doz. cookies? 30¢

5. John needs 32 yd. of wire netting for a fence around his garden. The netting is sold in rolls, each containing 100 ft. of netting. How many rolls does John need? 1

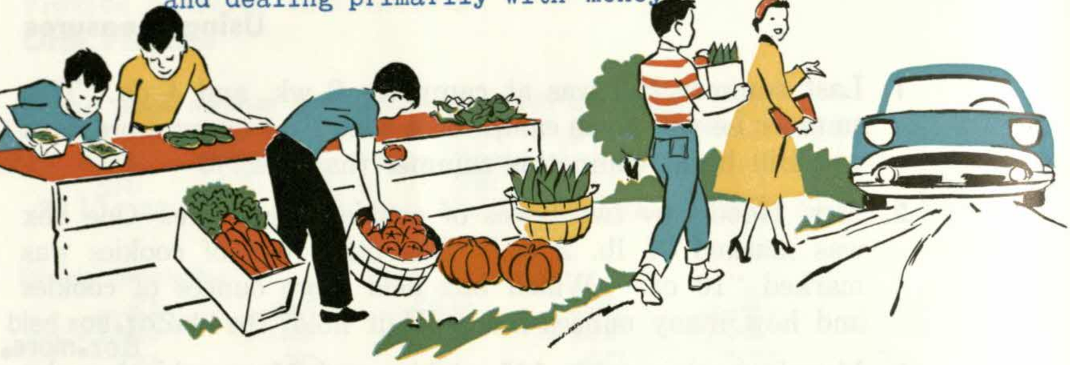
6. Ted sold 320 half-pint containers of ice cream at 15¢ each. How many quarts of ice cream would this be? 80 How many gallons? 20 How much did Ted get for the ice cream? $48.00 At this rate, how much would 1 gal. cost? $2.40

Tell the number that goes in each space:

7. 6 ft. = $\overset{2}{\ldots}$ yd. $\frac{1}{4}$ yd. = $\overset{9}{\ldots}$ in. 45 min. = $\overset{\frac{3}{4}}{\ldots}$ hr.
8. 6 mo. = $\overset{\frac{1}{2}}{\ldots}$ yr. 3 hr. = $\overset{180}{\ldots}$ min. 12 gal. = $\overset{48}{\ldots}$ qt.
9. $\frac{1}{2}$ bu. = $\overset{2}{\ldots}$ pk. $\frac{3}{4}$ hr. = $\overset{45}{\ldots}$ min. 45 sec. = $\overset{\frac{3}{4}}{\ldots}$ min.
10. $\frac{1}{2}$ yd. = $\overset{18}{\ldots}$ in. 2 qt. = $\overset{\frac{1}{2}}{\ldots}$ gal. 24 qt. = $\overset{6}{\ldots}$ gal.
11. 2 lb. = $\overset{32}{\ldots}$ oz. 9 ft. = $\overset{3}{\ldots}$ yd. $\frac{1}{2}$ min. = $\overset{30}{\ldots}$ sec.
12. $\frac{1}{4}$ bu. = $\overset{8}{\ldots}$ qt. 8 qt. = $\overset{2}{\ldots}$ gal. $\frac{1}{2}$ ton = $\overset{1000}{\ldots}$ lb.
13. 6 yd. = $\overset{18}{\ldots}$ ft. $\frac{1}{2}$ hr. = $\overset{30}{\ldots}$ min. 12 pt. = $\overset{6}{\ldots}$ qt.
14. 4 oz. = $\overset{\frac{1}{4}}{\ldots}$ lb. 3 yr. = $\overset{36}{\ldots}$ mo. $\frac{1}{2}$ gal. = $\overset{2}{\ldots}$ qt.
15. 1 mi. = $\overset{5280}{\ldots}$ ft. $\frac{3}{4}$ yd. = $\overset{27}{\ldots}$ in. 28 da. = $\overset{4}{\ldots}$ wk.

Have pupils refer to "Tables of Measures" on page 305 before beginning this review. Remind pupils that in changing from smaller unit to larger one we divide, from larger one to smaller we multiply.

Present review problems involving the 4 basic processes, and dealing primarily with money



Problems

Remind pupils to read problems carefully (see page 2).

1. One Saturday four boys sold vegetables from their gardens. When the vegetables were sold, the boys had a total of \$14.72. If the boys shared the money equally, what was each boy's share? \$ 3.68

2. Jane bought a schoolbag for \$2.50, a ball-point pen for \$1.25, a pencil for \$.85, and a notebook for \$.25. How much did all these things cost? \$ 4.85

3. Andy and his father drove 225 mi. to Little Falls. It took them 7 hr. to make this trip. About how many miles per hour did they average? About 32

4. When Mr. Smith sends blueberries to market he puts 24 pint boxes in one case. How many cases will he need for 600 pint boxes of blueberries? 25

5. This week Mrs. Wood paid Betty \$2.75 for baby-sitting. Betty told Jean that was \$.75 less than she earned last week. How much did Betty earn last week? \$ 3.50

6. Patty's new winter coat cost \$19.79. It had been marked down from \$27.50. How much money did Patty save? \$ 7.71

7. Jim opened 15 cases of canned soup and put the cans on shelves in the store. There were 24 cans in each case. How many cans of soup did Jim put on shelves? 360

8. Peter gave the clerk in the grocery store \$5.00 to pay for groceries that cost \$3.17 all together. How much change did the clerk give Peter? \$ 1.83

Let volunteers explain their solutions and show work at board. Have pupils make up original problems for class to solve from newspaper advertisements. Let them make arithmetic scrapbooks in which to keep problems and other projects.

Problems without Questions

The problems on this page are not complete because no question has been asked. Make a good question for each problem, using all the facts that are given. Then find the answer:

1. Jim bought a suit for \$14.95. It had been marked down from \$18.50.
2. Mary earned \$9.75 baby-sitting for Mrs. Wood and \$6.35 going on errands for Miss Williams.
3. George bought a fountain pen that cost \$4.85. He gave the clerk \$10.00 to pay for it.
4. Betty had 85¢ to buy picture post cards. The cards cost 7¢ apiece.
5. Mr. Johnson used 67 gal. of gasoline last month. He drove his car 1206 mi. on that amount of gasoline.
6. Jack got 7¢ for every ice cream cone he sold at the ball game. All together he sold 429 cones.
7. A party for 35 pupils and teachers cost \$15.05.
8. Patty is 3 in. taller than her sister Mary Ann. Mary Ann is 59 in. tall.
9. There are 11,612 persons living in Grandview this year. This is 385 persons more than there were last year.
10. Jim wants to save \$15.00 to use for Christmas presents. He has saved \$8.45 so far.
11. A train averages 59 mi. an hour. It makes a trip of 475 mi. from Cape May to Danbury.
12. It costs Peter 48¢ a day for his lunch at school and his bus fare. Peter went to school every one of the 23 days of school last month.
13. It took Mr. West 6 hr. to drive his car 234 mi.
14. The train due to arrive in Boston at 6:39 P.M. did not arrive until 7:14 P.M.

Evaluate pupils' thinking ability and understanding of problem situations through questions they suggest. Urge class to evaluate questions suggested (does it make sense, would it ever be asked) and then solve problems.

See G-23 for correlation of examples with aims.

Chapter Review

1. Alice read that Mt. Washington is 6288 ft. high. Is Mt. Washington more than a mile high? Yes If so, how much more than a mile high is it? 1008 ft.

2. Mrs. Chase spent $128.65 for food for her family during the month of July. How much did she spend per day, on the average, for food? $4.15

3. Jim started to rake leaves at 9:20 A.M. He stopped at 11:05 A.M. How long did Jim rake leaves? 1 hr. 45 min.

4. How many minutes is it from 4:45 P.M. to 6:03 P.M.? 78

5. Find the product of 9406 and 87. 818,322

6. How much more is $400.00 than $263.78? $136.22

7. Find the sum of 2736, 487, 5129, and 2639. 10,991

8. Find the remainder if you divide 13,091 by 49. 267 and remainder of 8

9. Find the difference between 46,789 and 83,353. 36,564

10. Read these numbers: LXXVI 76, MDCCI 1701, XLIV 44, MCM 1900, DCX 610, XCVII 97, MM 2000, CCIX 209.

11. Write these numbers in Roman numerals: 48 XLVIII, 65 LXV, 83 LXXXIII, 96 XCVI, 204 CCIV, 1492 MCDXCII, 1600 MDC, 1725 MDCCXXV, 1959 MCMLIX, 2035 MMXXXV.

12. Write these numbers in figures: Twenty-six thousand two hundred forty-six 26,246; eight hundred thousand 800,000; thirty million eighty 30,000,080; two billion seven million five hundred fifty-two thousand. 2,007,552,000

13. Round off each number to the nearest hundred:

937 900 481 500 995 1000 621 600 389 400 142 100

14. Round off each number to the nearest thousand:

1864 2000 4129 4000 5096 5000 3979 4000 8907 9000

15. Round off 5096 to the nearest hundred. 5100

16. Round off each number to the nearest ten-thousand:

42,943 40,000 86,099 90,000 15,358 20,000 54,832 50,000 11,436 10,000

Check papers carefully to determine kinds of errors made, and note results on pupils' progress cards. Return papers to pupils and help them analyze causes of errors. Provide remedial work as needed. Let others work at arithmetic corner.

A Problem Test

1. Bill counted all the ticket money the sixth grade pupils handed in. He had 52 one-dollar bills, 15 half dollars, 47 quarters, 88 dimes, 19 nickels, and 20 pennies. If the tickets sold for 35¢ each, how many tickets had been sold? 232

2. Mr. Wood filled the tank of his car with 17 gal. of gasoline. Find the cost of the gasoline at \$.26 a gallon. \$4.42

3. Ann bought a sweater for \$3.95. How much change did she get from \$10.00? \$6.05

4. Betty paid \$11.00 for 4 yd. of cloth for a new suit. What was the price of the cloth per yard? \$2.75

5. At a book sale 438 books were sold at \$1.95 apiece. How much money did all these books bring in? \$854.10

6. Mr. Stone can average 39 mi. an hour when he drives on long trips. About how many hours of driving does he need for a trip of 665 mi.? About 17

7. Peter spent \$1.79 for a shirt, \$15.50 for a suit, \$.50 for a tie, \$.57 for socks, \$1.69 for gloves, and \$5.95 for shoes. How much in all did Peter spend? \$26.00

8. For new pillow covers, curtains, and a bedspread Susan needs 648 in. of material. How many yards of material should she buy? 18

9. Jim needs \$95.00 for his vacation at camp next summer. He has saved \$67.35 so far. How much more money does Jim need to save? \$27.65

10. At the beach a small cottage can be rented for \$49.50 a week. What is the rent of this cottage for 6 wk.? \$297.00

How many problems did you get right? Look below to find out what your score means.

SCORE	0–5	6–7	8–9	10
	You need help	Fair	Good	Excellent

Have pupils keep own records of problem-test scores;
see G-23, 24 for suggestions for individual charts.
Urge pupils who had no errors to make up original problems
for arithmetic corner. Group others for remedial work.

Present diagnostic tests of skills reviewed in Chapter 1 with page references for remedial work.

How Much Have You Learned?

If you miss more than one example in a row, turn to the Practice Pages for that row.

Add and check:

						Practice Pages
1.	146 672 759 283 314 2174	845 989 417 983 755 3989	156 692 526 384 627 2385	968 171 420 407 819 2785	376 509 482 571 248 2186	9
2.	3536 4658 1943 2206 12,343	4715 7863 935 1487 15,000	1485 8276 6533 773 17,067	4382 6644 3600 3579 18,205	3065 656 274 3705 7700	9

Subtract and check:

3.	5402 3865 1537	5325 4695 630	60001 28423 31,578	90258 63699 26,559	13
4.	4367 2369 1998	7674 4837 2837	43817 16325 27,492	60000 39753 20,247	13

Multiply and check:

5.	259 239 61,901	956 481 459,836	673 257 172,961	1549 76 117,724	4817 83 399,811	16
6.	928 407 377,696	846 905 765,630	738 106 78,228	952 560 533,120	437 290 126,730	17

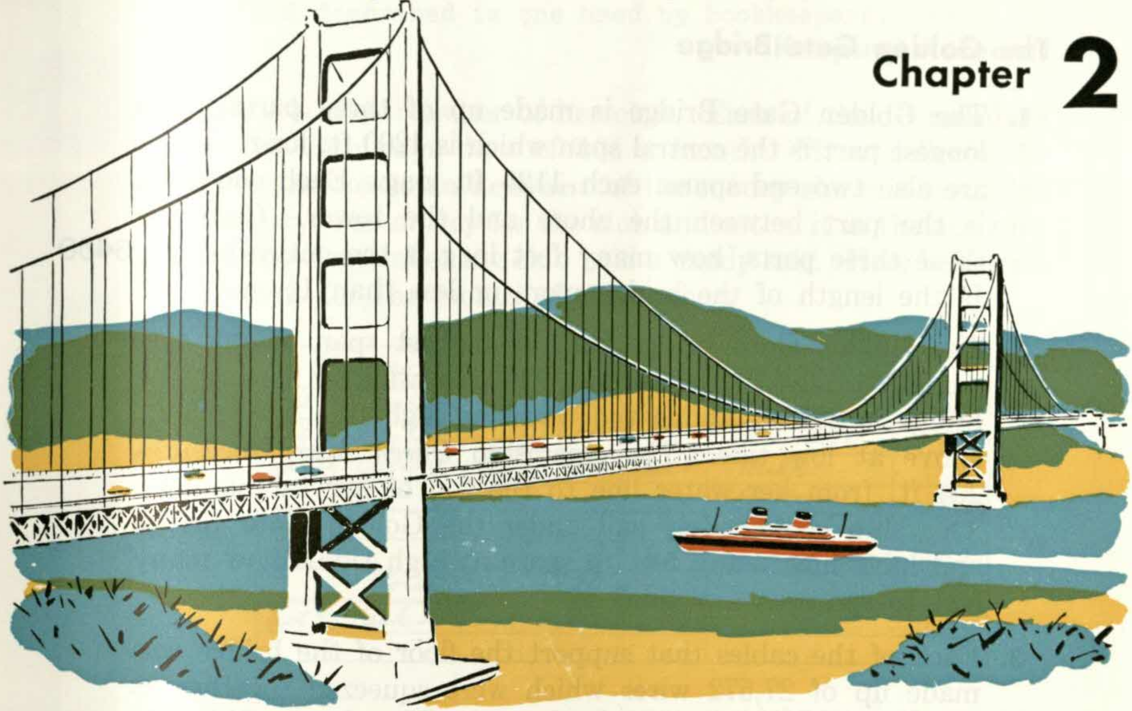
Divide and check:

7.	45 R13 44)1993	67 R6 63)4227	738 21)15498	29, 30
8.	148 R22 28)4166	217 R6 56)12158	923 78)71994	32, 33
9.	209 R7 52)10875	4006 29)116174	6080 R11 45)273611	35

Note that each process is tested by sets of examples. If pupil has errors in two or more examples of a set, something fundamental is probably wrong, necessitating reteaching or drill. After correcting difficulty, assign practice pages.

See G-26 for specific aims of Chapter 2.

Chapter 2



The Golden Gate Bridge

Review problem solving involving mixed operations (pages 43-44).

1. San Francisco has a very large bay which is one of the world's greatest harbors. The channel which connects the bay with the Pacific Ocean is called the Golden Gate. In 1937 a beautiful suspension bridge crossing the Golden Gate was completed. How many years ago was that?
2. A suspension bridge is one which has its roadway suspended from huge cables that pass over high towers at each end of the bridge. The distance between the towers is called the central span of the bridge. In the picture above, point to the towers, the cables, the central span, and the roadway.
3. The Golden Gate Bridge has the longest central span of any bridge in the world. This span is 4200 ft. long. How much less than a mile is the central span? 1 mi. = 5280 ft. 1080 ft.
4. The two great steel towers are each 746 ft. high. If a building were 746 ft. high, how many stories would it have if 12 ft. were allowed for each story? 62

Do problems orally with pupils. Let different ones read problem, another write it in numerical language on board, then have class solve it.

The Golden Gate Bridge

1. The Golden Gate Bridge is made up of three parts. The longest part is the central span which is 4200 ft. long. There are also two end spans, each 1125 ft. long. Each end span is the part between the shore and the tower. Counting these three parts, how many feet long is the entire bridge? 6450 Is the length of the bridge more or less than $1\frac{1}{4}$ mi.? Less

2. The Golden Gate Bridge has the highest span of any suspension bridge in the world. The roadway or floor of the bridge is 220 ft. above the water at high tide and 236 ft. above at low tide. The steamship *Queen Mary* measures 204 ft. from her water line to the top of her tallest mast. This ship could safely sail under the Golden Gate Bridge and have how many feet to spare at high tide? 16 how many feet to spare at low tide? 32

3. Each of the cables that support the floor of the bridge was made up of 27,572 wires which were squeezed together as tightly as possible and then covered. When each cable was finished, it had a diameter of 3 ft. Draw a circle on the board with a diameter of 3 ft. to show how big each cable is.

4. During a recent year 21,075,000 cars and trucks passed over the Golden Gate Bridge. This was an average of how many cars and trucks per month? 1,750,000 Round off 21,075,000 to the nearest million before finding the average. 21,000,000

5. If the average charge was 50¢ for each car or truck that crossed the bridge, how much money was collected, on the average, per month? $ 875,000.00 Use the answer to ex. 4.

6. The first great suspension bridge to be built was the famous Brooklyn Bridge, completed in 1883, which connects Brooklyn with New York. This bridge is still in use. For how many years has the Brooklyn Bridge been used? The central span of the Brooklyn Bridge is 1595 ft., while that of the Golden Gate Bridge is 4200 ft. Is the central span of the Brooklyn Bridge less than one half that of the Golden Gate Bridge? If so, how many feet less is it? 505

Have pupils do problems independently, then let volunteers explain work at blackboard. Group pupils who made errors to determine causes. Are they computing incorrectly? Do they understand problem situations? Are they using wrong process?

Teach pupils how to keep cash accounts (pages 45–47).
The method described is one used by bookkeepers.

Keeping Accounts

1. Mary is the treasurer of her club. Each of the 19 members of the club pays dues of 10¢ a month. Mary collects the dues and keeps an **account** of the money she receives. She also pays out money for the club and enters it in the account. During September the club held a candy sale. Here is Mary's account for the month of September:

Money Received				Money Paid Out			
Sept. 7	Dues	1	40	Sept. 19	Sugar		49
Sept. 14	Dues		50		Chocolate		51
Sept. 22	Candy sale	4	80	Sept. 21	Milk		23
					Butter		34
				Sept. 22	Paper bags		10
				Sept. 30	Cash on hand	5	03
	Total	6	70			6	70
Sept. 30	Cash on hand	5	03				

2. In September Mary received a total of $6.70 and spent a total of $1.67. Study the account and explain each of the amounts entered in it.

3. When Mary subtracts $1.67 from $6.70 she finds that she should have $5.03 left in cash. $5.03 is called the **cash on hand.** Mary counts her cash and finds that she really has $5.03 left, so she writes "Cash on hand, $5.03" on the right side of the account and adds that side. The sum is $6.70; the account **balances** because both sides give a total of $6.70. Mary draws double lines under $6.70 on both sides to show that the account above these lines is correct. She then starts a new account, writing "Cash on hand, $5.03" on the left side under $6.70.

4. If Mary does not have the right amount of cash on hand to make her account balance, she may have forgotten to write down some amounts that she spent. If Mary had forgotten to write down the $.10 for paper bags, what would happen when she tried to balance her account? What would happen if she forgot to enter some dues she had received? See G–27.

Discuss account in ex. 1 carefully. Point out that each side shows the date, description, amount (dollars and cents separated) of every transaction. Emphasize that account is balanced (and correct) when each side has same total.

Jack's Cash Book

1. Jack keeps an account of all the money he receives and spends. His account for one week is shown below:

Money Received				Money Paid Out			
Oct. 2	Cash on hand	1	85	Oct. 3	Club dues		15
Oct. 3	Cleaning yard		50	Oct. 5	Movies		35
Oct. 6	Washing car		75	Oct. 7	Football	2	59
Oct. 7	Allowance		75	Oct. 9	Cash on hand		
		3	85			3	09

2. Balance Jack's account and tell how much cash he ought to have on hand on Oct. 9. $.76

3. When Jack counted his cash on Oct. 9 he had only $.61 on hand. How much cash was he short? $.15 Then he remembered that he spent $.15 for candy on Oct. 6 and forgot to write it down. Will his account balance now? Yes

4. The next week Jack's account showed these items on the "Received" side: Oct. 9, $.61 cash on hand; Oct. 10, $.25 for running an errand; Oct. 12, $.85 for helping at the store; Oct. 14, $.75 for allowance; Oct. 15, $.35 for raking leaves. These items were on the "Paid Out" side: Oct. 10, $.30 for bus fare; Oct. 10, $.25 for lunch; Oct. 12, $.75 for birthday gift; Oct. 13, $.25 for notebook; Oct. 14, $.12 for stamps. Write Jack's cash account for that week and balance it. See G-27.

Discuss this work thoroughly with pupils. When they do ex. 4, emphasize importance of writing the account neatly and carefully. Check pupils' work as they do this.

1. A book in which you keep an account of the money you receive and spend is called a **cash book.** Make a cash book for your own use by drawing lines on a sheet of paper like those in Jack's account on page 46.

2. At the end of the week see if your account balances. To do this, count your cash on hand and enter it on the right side of your cash book. Then add the numbers on both sides of the book. If the sums are alike, your account balances, which means that it is correct. If the sums are not alike, the account is incorrect. In this case, try to think of any money you received or spent that you forgot to enter in your cash book. If you remember such items, write them in the book and then see if the account balances. Always enter promptly any money you receive or spend.

3. On a sheet of paper draw lines for an account and enter these items as "Received": Oct. 9, $.85 cash on hand; Oct. 10, $1.50 for baby-sitting; Oct. 11, $.25 for delivering cookies; Oct. 15, $1.00 for allowance; Oct. 15, $.45 for selling used book. Also enter these items as "Paid Out": Oct. 11, $.30 for movies; Oct. 13, $.35 for lunch; Oct. 13, $.95 for present for Mother; Oct. 14, $1.75 put in bank; Oct. 15, $.05 for pencil; Oct. 15, $.35 for lunch. Then balance the account. How much cash ought you to have on hand on Oct. 16?
See G–28.

4. Here is Bob's account for a week. Money received: Nov. 1, cash on hand, $1.15; Nov. 1, allowance, $1.00; Nov. 4, for old paper, $.65; Nov. 6, for raking leaves, $.75. Money paid out: Nov. 2, notebook, $.19; Nov. 3, ice cream, $.15; Nov. 5, ball-point pen, $.95; Nov. 6, movies, $.30. Nov. 8, Bob's cash on hand was $1.96. Make out the account and balance it. See G–28.

5. Make up a problem like ex. 4, showing Ann's account for a week. Tell the amounts she received, giving the date for each item. Also tell the amounts spent with the date for each. Make out the account and balance it.

As in ex. 4 on page 46, be sure pupils make their accounts carefully. Encourage them to keep their accounts for a month or longer. Post the accounts made for ex. 5 on bulletin board for further reference.

Reteach the solving of two-step problems and prepare for solving of three-step problems.

Hidden Questions in Problems

1. **Problem** Jim wants to buy a new camera that costs \$9.75. He has already saved \$4.65 toward the cost. If he can save \$.85 a week, how many weeks will it take him to save the rest of the money for the camera? 6

Explanation This is a two-step problem.

First Step. In this step you have to answer this question: How much more money must Jim save? To find out, subtract \$4.65 from \$9.75, which gives \$5.10. Jim still has to save \$5.10.

$$\begin{array}{r} \$9.75 \\ 4.65 \\ \hline \$5.10 \end{array}$$

The question you have just answered is, "How much more money must Jim save?" This is called the **hidden** question because it is not asked in the problem. When you read the problem you have to find this hidden question and answer it before you can work the second step.

Second Step. You are now ready to answer the question asked in the problem, which is: "How many weeks will it take him to save the rest of the money?" To find out, divide \$5.10, the amount Jim must still save, by \$.85, the amount he can save in a week. Write \$5.10 as 510¢ and \$.85 as 85¢, as shown at the right. It will take Jim 6 weeks to save the rest of the money for the camera.

$$\begin{array}{r} 6 \\ 85\overline{)510} \\ 510 \\ \hline \end{array}$$

In each of these problems below there is a hidden question. Find the hidden question, answer it, and then answer the question asked in the problem:

2. Jean bought 6 handkerchiefs at \$.39 apiece. How much change did she get from \$5.00? How much did the 6 handkerchiefs cost? (\$2.34); \$2.66

3. Ted took 3 friends to the movies. He bought 4 tickets at \$.65 each and paid \$.60 for ice cream afterwards. How much in all did Ted spend? How much did the 4 tickets cost? (\$2.60); \$3.20

4. For a school party Miss Field ordered 20 qt. of ice cream at \$2.15 a gallon. How much did the ice cream for the party cost? How many gallons are there in 20 qt.? (5 gal.); \$10.75

Emphasize fact that pupils must look for and answer hidden question first in order to answer the question in the problem. Have them write hidden question first. Also, have pupils estimate answers for each step in the problem.

1. Mrs. Johnson buys 3 qt. of milk each day at $.21 a quart. What was the amount of her milk bill for November? $18.90

2. Bob is saving to buy a wrist watch that costs $14.25. He saved $3.50 in October and $3.95 in November. How much more does he need to buy the watch? $6.80

3. Betsy's father drove her 117 mi. to camp. They left home at 9:30 A.M. and arrived in camp at 12:30 P.M. Find the average number of miles they drove per hour. 39

4. Jim sells ice cream cones at school ball games. The last four Saturdays he sold 238 cones, 215 cones, 275 cones, and 308 cones. Find the average number he sold per game. 259

5. The price of the magazine that Ann wants is $3.50 a year. She can get it for two years for $6.00. How much will Ann save by taking the magazine for two years at $6.00 instead of taking it at $3.50 each year for two years? $1.00

6. Henry and Peter paid $18.50 for a small tent and $9.98 for a camp lantern. If the boys shared the cost equally, how much did each boy pay? $14.24

7. Handkerchiefs cost $.39 each or 6 for $1.98. How much can be saved on each handkerchief by buying 6 at a time? $.06

8. Susan bought a box of 48 packages of seeds for $2.00. She sold all the seeds at $.07 a package. How much more did she get for the seeds than she paid for them? $1.36

9. Andy bought 2 bicycle tires at $2.98 each. He also purchased a wire basket for $1.79, a headlight for $3.59, and a horn for $.85. How much did Andy spend all together? $12.19

10. The girls in the cooking class made 220 cookies. They sold 9 doz. cookies and used the rest for a class party. How many cookies did they have for the party? 112

11. George can buy one roll of film for his camera for $.45 or 3 rolls for $1.20. How much can he save by buying 3 rolls at one time? $.15

Insist that pupils write hidden questions first and estimate answers for each step. Encourage pupils who have difficulty to do their computations aloud so you may discover causes.

Present word problems dealing with insects (pages 50–52).

Insect Enemies

Many insects are enemies of man because each year they injure or destroy our trees, grains, vegetables, and fruits. In our homes they ruin clothing, rugs, and food. They also damage our livestock and livestock products.

1. The total damage in this country by insects and the cost of trying to control them is $4,000,000,000 or more a year. There are about 185,000,000 people in the United States. If each one should pay $20, would the amount of money raised be enough to pay for the damage done by insects in one year? $ 3,700,000,000; no

2. Every now and then someone has to throw away a partly used package of flour, nuts, or other food because it has been spoiled by insects. There are about 53,000,000 families in the United States. What would be the total loss if each family threw away during one year food worth 50¢ that was spoiled by insects? $ 26,000,000 If each family threw away food worth 75¢? $ 39,750,000

It may be necessary to review work on large numbers on pages 4 and 27 before doing these problems. Note that problems on these pages may be correlated with science.

3. Grasshoppers damage several kinds of crops and plants. Grasshoppers are found all over the United States but most of their damage is done in the western $\frac{2}{3}$ of the country. It is estimated that the losses due to grasshoppers in the grasshopper region amounted to \$789,000,000 in the 25 years from 1925 to 1950. What was the average loss per year due to damage by grasshoppers? \$ 31,560,000

4. For a recent year 20 states reported a total loss of \$27,376,000 due to grasshopper damage. In that year what was the average loss per state due to grasshopper damage? \$ 1,368,800

5. In one year the damage caused by insects to certain of our crops was estimated to cost these amounts:

Corn	\$136,278,000	Cotton	\$114,058,000
Potatoes	55,111,000	Apples	21,816,000
Wheat	56,190,000	Peaches	8,687,000

Find the total amount of the damage to these crops. \$392,140,000

Discuss problems with pupils, and have volunteers explain their work and give reasons for processes used.

Insect Enemies

1. Insects cause great damage because there are so many of them. About 686,000 *different kinds* of insects have been named. Suppose you should try to learn the names of all these kinds of insects. If you could learn the names of 25 insects each day, how many days would it take to learn the names of 686,000 kinds of insects? 27,440 How many weeks would it take? 3920 About how many years? About 75

2. Beetles far outnumber other kinds of insects. About $\frac{2}{5}$ of the named kinds of insects are beetles. Ants, butterflies, bees, flies, wasps, and other insects make up the remainder. About how many kinds of insects are beetles? See ex. 1. 274,400

3. About $\frac{1}{8}$ of the named kinds of insects have been found in North America. About how many kinds of insects have been found in North America? See ex. 1. 85,750

4. In certain years much damage is done to trees by the *periodical cicada* or *17-year locust*. These locusts appear every 17 years in the North; during the other years they remain buried in the ground. In the town where Jack lives the 17-year locusts came the summer that he was 5 years old. How old will Jack be the next time the locusts come? 22 yr. the next two times they come after that? 39 yr.; 56 yr.

5. In the South the locusts appear every 13 years instead of every 17 years as in the North. How many times would the 13-year locusts come during a period of 60 years if they first appear during the 13th year of this 60-year period? 4

6. When an insect is in danger, it often jumps or flies out of the way. A flea can jump 100 times as high as it is tall. If a boy 5 ft. tall could jump as well as a flea, he could jump 100 times his height. How high would that be? 500 ft. Could he jump over a 40-story skyscraper if each story were 12 ft. high? Yes

LOCUST

MOTH

GRASSHOPPER

Present review of addition and subtraction.

Addition and Subtraction

Add and check:

1.	3226	5313	9557	6336	7352	4015
	1136	3755	4374	803	2678	677
	284	1016	756	4969	957	1586
	3148	2185	4645	9825	6460	7492
	4600	9228	8274	2017	5848	3818
	12,394	21,497	27,606	23,950	23,295	17,588
2.	1499	7080	4848	4460	9633	2998
	2594	317	3121	3523	1597	4614
	9312	6563	1645	8287	704	5007
	8658	412	7360	6557	2729	986
	6977	4279	5297	1146	4337	1478
	29,040	18,651	22,271	23,973	19,000	15,083

Copy in columns, add, and check:

3. 5385 + 3147 + 8002 + 1984 + 2617 + 4796 25,931

4. 2875 + 11,386 + 939 + 4406 + 2253 + 2568 24,427

5. 6915 + 4676 + 10,755 + 5616 + 859 + 4179 33,000

6. 62,987 + 9727 + 904 + 8323 + 4494 + 5329 91,764

7. From $200.00 subtract $178.36; $21.64 take 6425 from 7000. 575

8. Find the difference between $575.00 and $398.75. $176.25

9. How many feet longer than 1 mi. are 7146 ft.? 1866

10. What is the change from $10.00 for a purchase of $9.64? $.36

Subtract and check:

11.	35488	58194	43317	80000	32443
	15254	25475	24654	3086	22578
	20,234	32,719	18,663	76,914	9865
12.	62385	30000	68230	91554	70002
	47426	14175	23631	23476	49257
	14,959	15,825	44,599	68,078	20,745
13.	86565	50923	73873	66925	80600
	67078	33653	38986	19389	79358
	19,487	17,270	34,887	47,536	1242

More Practice. See ⑫ on page 314. Use to reinforce skills.

Check each pupil's paper carefully to determine kinds of errors made. Return papers to pupils so they may find and correct their mistakes. Clear up difficulties through individual conferences before assigning remedial work.

Present procedure for giving and scoring improvement tests (pages 54–58).

Improving Your Skill

In the sixth grade you should begin to improve your skill in arithmetic so that you can work more rapidly and still have correct answers. The Improvement Tests in this book will help you because they will give you a way to improve your scores. You will find 3 addition tests on page 55, which are called Addition Tests 1a, 1b, and 1c. More addition tests are given on other pages of this book. If you take these tests the **right way,** they are sure to help you improve your skill.

1. When you take Addition Test 1a on page 55, the teacher will time you, allowing 5 min. for the test. At the end of the 5 min., you will stop work and the teacher will read the answers to the examples. There are 10 examples in Addition Test 1a, so your score will be 10 if you get all the examples right. If you get only 8 examples right, your score will be 8.
2. Suppose that you get a score of 8 today on Test 1a. Tomorrow the teacher will have the class take Addition Test 1b. This test is like Test 1a since each test contains 10 examples of the same kind in column addition. The teacher will give Test 1b the same way as described above, allowing 5 min. for it. Try to improve your score this time, so that it will be better than the score of 8 which you got on Test 1a. Suppose you get a score of 9 on Test 1b.
3. A day or so later the teacher will give you Addition Test 1c. **Never take more than one test a day.** Possibly you will get a score of 10 this time. But do not get discouraged if you fail to get 10, because you are sure to improve if you take each set of 3 tests in the way described above. Stress.
4. About a week later, the teacher will start you on a set of 3 subtraction tests which will help you better to subtract; see page 67. Later on, you will take some multiplication and division tests; see pages 74 and 95. All these tests are called Improvement Tests because they help you to improve your skill in arithmetic. Emphasize.

To the Teacher. See pages 56, 327, and 328 before giving Addition Test 1a.

Refer also to G-30-32 for important discussion of purpose, description, procedure, and records for improvement tests. Discuss carefully with pupils material on this page. Point out that they will be competing only with themselves.

Note that only "one" test of a set should be administered on given day. Tests should be given in period of 5 to 7 days.

Improving by Practice

Addition Test 1a

Time: 5 min.

1.	334	532	376	275	468	
	286	378	817	552	154	
	412	466	343	299	968	
	293	576	464	507	354	
	1325	1952	2000	1633	1944	
2.	173	343	897	301	128	
	216	850	928	417	694	
	835	979	654	241	149	
	637	468	149	603	744	⑩
	1861	2640	2628	1562	1715	

Addition Test 1b

Time: 5 min.

3.	713	132	534	486	174	
	258	275	176	146	527	
	524	807	665	894	993	
	465	355	436	283	306	
	1960	1569	1811	1809	2000	
4.	523	813	157	376	440	
	786	579	192	960	782	
	660	258	846	939	311	
	298	478	579	684	168	⑩
	2267	2128	1774	2959	1701	

Addition Test 1c

Time: 5 min.

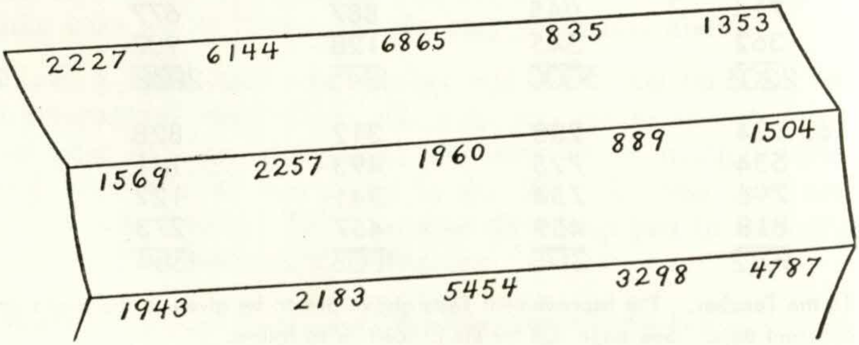
5.	628	683	296	793	957	
	499	807	534	455	636	
	714	965	887	677	788	
	362	545	128	907	449	
	2203	3000	1845	2832	2830	
6.	924	238	312	828	551	
	534	725	493	141	467	
	796	754	341	122	301	
	818	459	457	273	388	⑩
	3072	2176	1603	1364	1707	

To the Teacher. The Improvement Tests above are to be given to the pupils on three different days. See page 328 for the procedure to follow.

Read and discuss material on page 56 before giving first test. Be sure pupils understand use of folded paper. Group pupils who had errors to help them determine causes (facts, carrying, and so on). Let others work at arithmetic corner.

Using Folded Paper

1. When you take an addition test like those on page 55, or a subtraction test like those on page 67, do not copy the examples. Instead, lay a sheet of paper on the book with its edge **under** the top row of examples. Then write the answer to each example on the edge of the paper, as shown at the bottom of this page.
2. When you finish the answers to the first row of examples, fold the answers **under;** then write the answers to the second row along the folded edge, as shown below. Continue in this way for each row of examples. It saves time to fold the paper **before** taking the test. Each fold should be about 1 inch wide.
3. Folded paper cannot be used for tests in multiplication and division like those on pages 74 and 95. In taking such tests you should copy the examples on paper **before** the test begins. In copying, spread the examples over the paper so as to give room enough to work them. Emphasize.
4. Work on each test only the number of minutes given for that test, and stop work **at once at the end of that time.** Stress. You cannot compare your scores on the 3 tests in a set unless you allow exactly the same number of minutes for each one of the tests.
5. If you finish a test before the time to stop, check as many of the examples as you can in the time that is left.



Demonstrate how the paper should be folded and used. Walk around room as pupils prepare their papers to be sure it is done correctly. Emphasize that pupils must stop work at end of test.

Using a Scoring Table

NUMBER OF EXAMPLES IN TEST	NUMBER OF EXAMPLES RIGHT															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
4	0	3	5	8	10											
5	0	2	4	6	8	10									B	
6	0	2	3	5	7	8	10									
7	0	1	3	4	6	7	9	10								
8	0	1	3	4	5	6	8	9	10							
9	0	1	2	3	4	6	7	8	9	10						
10	0	1	2	3	4	5	6	7	8	9	10					
12	0	1	2	3	3	4	5	6	7	8	8	9	10		C	
A → 15	0	1	1	2	3	3	4	5	5	6	7	7	8	9	9	10

1. When a test contains 10 examples, it is easy to score it; if you get 9 examples right, your score is 9. When a test contains 15 examples, like the tests on page 67, your score is 10 if you get 15 examples right; but what is your score if you get 14 examples right, 9 or only 12 right? 8 The scoring table above answers this question.

2. Suppose you take a test containing 15 examples and you get only 12 examples right. You find your score in the table like this: Since the test had 15 examples, look down the first column on the left side of the table until you come to the row marked 15 (shown by Arrow A). Then look along that row until you reach the column marked 12 at the top (shown by Arrow B) and you will find the number 8 (shown by Arrow C). This means that your score is 8 on that test.

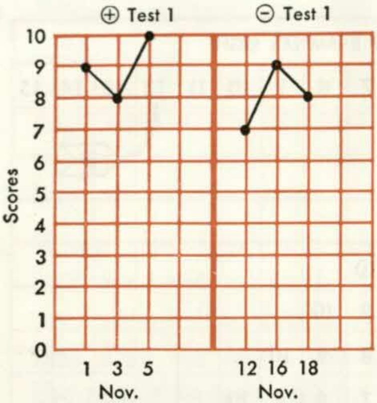
3. In the third row of Subtraction Test 1a on page 67 you see a number in a circle like this: ⑮. This tells you that this test contains 15 examples, so it is not necessary to count to see how many examples the entire test contains.

4. The scoring table shown above is also printed on page 329 of this book.

After discussing material on this page with pupils, give them further practice, like that in ex. 2, in using scoring table. Then have them find own scores for tests on page 55. Be sure all pupils know how to use table.

See G-31 for suggestions for making Score Book.

Recording Your Scores



Record of Joe's Scores

1. The picture at the left shows Joe's scores on some tests that he took. This picture is called a **line graph.**

2. The top of the first graph is marked "⊕ Test 1." This line graph shows Joe's scores for Addition Tests 1a, 1b, and 1c, on page 55. These three tests make up Test 1. ⊕ means "addition." You see three heavy dots on the graph. The first dot is on the horizontal line marked 9; this means that Joe's score on Test 1a was 9. The first dot is also on the vertical line marked 1 at the bottom of the graph; this means that Joe took Test 1a on Nov. 1. The second dot shows Joe's score on Test 1b; his score was 8 and he took the test on Nov. 3. What was his score on Test 1c and on what date did he take that test? 10 on Nov. 5 The dots on a line graph are connected by drawing lines between them.

3. The second graph headed "⊖ Test 1" gives Joe's scores on the 3 subtraction tests on page 67. ⊖ means "subtraction." What were his scores on these three tests and on what dates did he take them? 7 on Nov. 12; 9 on Nov. 16; 8 on Nov. 18

4. You should make a **Score Book** in which you can make a line graph of your scores for each set of tests. It will be a record of your scores on all the Improvement Tests that you take this school year. This book can be easily made from a few sheets of squared paper. Always watch your scores to see whether you are improving or not.

Be sure all pupils record scores and make line graphs correctly.

5. When you find your score on a test, count only the examples that are entirely right. An example that is partly finished does not count.

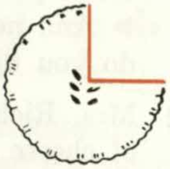
Before discussing ex. 1-5 review function of graphs and ask pupils if they know of any other kinds of graphs (bar graphs, page 28). As material is explained in ex. 2-3, have pupils actually locate dates and scores on the graph.

Review meanings in relation to common fractions and review fundamental principle of fractions.

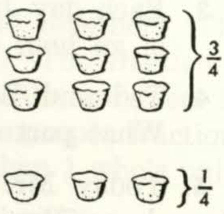
Fractions

1. A fraction may have different meanings, as shown below:

(1) The picture at the right shows $\frac{3}{4}$ of a pie. Here the fraction $\frac{3}{4}$ stands for **three of the four equal parts of one thing.** This same meaning of a fraction is shown by $\frac{1}{2}$ of an orange or $\frac{2}{3}$ of a cake.



(2) Ann's mother used $\frac{3}{4}$ of a dozen cupcakes. Here the fraction $\frac{3}{4}$ stands for **three of the four equal parts of a group of things.** The group is 12 cakes. Then $\frac{3}{4}$ of 12 cakes is 9 cakes. This same meaning of a fraction is used when you say $\frac{2}{3}$ of 9 hens, or $\frac{1}{2}$ of 16 oz.



(3) A fraction can also indicate division. The fraction $\frac{3}{8}$ means $3 \div 8$. Likewise, the fraction $\frac{7}{16}$ means $7 \div 16$.

In ex. 2, point out that numerator tells number of parts being used.

2. In the fraction $\frac{3}{4}$, 3 is the **numerator** of the fraction and 4 is the **denominator** of the fraction. The numerator and denominator are called the **terms** of the fraction.

Point out that denominator names the parts and tells number of equal parts in whole or group.

3. You know that the fraction $\frac{3}{4}$ has the **same value** as the fraction $\frac{9}{12}$. A quick way to change the fraction $\frac{3}{4}$ to $\frac{9}{12}$ is to multiply both terms of $\frac{3}{4}$ by 3, as shown at A.

A. $\frac{3}{4} = \frac{3 \times 3}{4 \times 3} = \frac{9}{12}$ B. $\frac{9}{12} = \frac{9 \div 3}{12 \div 3} = \frac{3}{4}$

You can change $\frac{9}{12}$ back to $\frac{3}{4}$ by dividing both terms of $\frac{9}{12}$ by 3, as shown above at B. When you change $\frac{9}{12}$ to $\frac{3}{4}$, you express $\frac{9}{12}$ in lowest terms. A fraction is changed to lowest terms by dividing both terms by the largest whole number that will divide both exactly.

Demonstrate and emphasize.

If you multiply or divide both terms of a fraction by the same number, you get another fraction having the same value.

Demonstrate (use materials and drawings) different meanings of fractions as given in ex. 1. Have pupils use fractional parts to prove principle of fractions (boxed statement) and to show that only "form" of fraction is changed. Make class chart of unlike, equivalent fractions.

Review and give practice in changing fractions (pages 60-61). Emphasize that fraction is in lowest terms when there is no number, except 1, by which both numerator and denominator may be divided evenly.

Changing Fractions

1. Ann needs 27 in. of cloth to finish the dress she is making. What part of a yard should she buy? $\frac{3}{4}$

▶ Ann needs $\frac{27}{36}$ yd., which equals $\frac{3}{4}$ yd. By what number do you divide both terms of $\frac{27}{36}$ to change it to $\frac{3}{4}$? 9

2. Mrs. Rich bought 8 oz. of cheese. What part of a pound of cheese did she buy? $\frac{8}{16}$ lb., or $\frac{1}{2}$ lb.

3. Each day Judy practices 45 min. on the piano. What part of an hour does she practice each day? $\frac{45}{60}$ hr., or $\frac{3}{4}$ hr.

4. Ted and Bob together picked 16 qt. of berries one day. What part of a bushel is 16 qt.? 32 qt. = 1 bu. $\frac{16}{32}$ bu., or $\frac{1}{2}$ bu.

5. Today Mr. Wells drove his car 120 mi. all together. He drove 72 mi. this morning and then stopped for lunch. What part of the trip did he complete before lunch? $\frac{72}{120}$, or $\frac{3}{5}$

6. George goes away to school. He is away from home 9 mo. of the year. What part of the year is he away from home? $\frac{9}{12}$ yr., or $\frac{3}{4}$ yr.

In each exercise tell what number should be put in the numerator of the second fraction so that both fractions will be equal:

7. $\frac{1}{3} = \frac{?}{6}$ 2 $\frac{5}{8} = \frac{?}{16}$ 10 $\frac{4}{5} = \frac{?}{10}$ 8 $\frac{5}{12} = \frac{?}{60}$ 25 $\frac{3}{4} = \frac{?}{100}$ 75

8. $\frac{1}{2} = \frac{?}{4}$ 2 $\frac{2}{3} = \frac{?}{12}$ 8 $\frac{5}{6} = \frac{?}{12}$ 10 $\frac{7}{12} = \frac{?}{24}$ 14 $\frac{3}{5} = \frac{?}{100}$ 60

9. $\frac{3}{4} = \frac{?}{8}$ 6 $\frac{1}{4} = \frac{?}{16}$ 4 $\frac{2}{5} = \frac{?}{10}$ 4 $\frac{3}{10} = \frac{?}{50}$ 15 $\frac{1}{2} = \frac{?}{100}$ 50

10. $\frac{1}{2} = \frac{?}{6}$ 3 $\frac{1}{2} = \frac{?}{10}$ 5 $\frac{7}{8} = \frac{?}{16}$ 14 $\frac{1}{12} = \frac{?}{36}$ 3 $\frac{9}{10} = \frac{?}{100}$ 90

Change each fraction to lowest terms (1) and tell by what number you divide both terms: (2)

(1),(2) **11.** $\frac{4}{10}$ $\frac{2}{5}$, 2 $\frac{6}{18}$ $\frac{1}{3}$, 6 $\frac{8}{16}$ $\frac{1}{2}$, 8 $\frac{27}{36}$ $\frac{3}{4}$, 9 $\frac{15}{25}$ $\frac{3}{5}$, 5 $\frac{10}{15}$ $\frac{2}{3}$, 5 $\frac{20}{30}$ $\frac{2}{3}$, 10 $\frac{30}{50}$ $\frac{3}{5}$, 10 $\frac{50}{100}$ $\frac{1}{2}$, 50

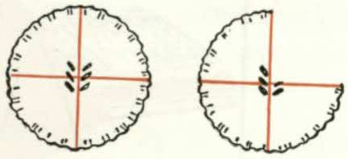
12. $\frac{12}{16}$ $\frac{3}{4}$, 4 $\frac{20}{24}$ $\frac{5}{6}$, 4 $\frac{16}{32}$ $\frac{1}{2}$, 16 $\frac{10}{18}$ $\frac{5}{9}$, 2 $\frac{15}{20}$ $\frac{3}{4}$, 5 $\frac{8}{40}$ $\frac{1}{5}$, 8 $\frac{50}{60}$ $\frac{5}{6}$, 10 $\frac{60}{80}$ $\frac{3}{4}$, 20 $\frac{60}{100}$ $\frac{3}{5}$, 20

13. $\frac{8}{12}$ $\frac{2}{3}$, 4 $\frac{12}{15}$ $\frac{4}{5}$, 3 $\frac{18}{24}$ $\frac{3}{4}$, 6 $\frac{8}{32}$ $\frac{1}{4}$, 8 $\frac{14}{16}$ $\frac{7}{8}$, 2 $\frac{9}{12}$ $\frac{3}{4}$, 3 $\frac{10}{20}$ $\frac{1}{2}$, 10 $\frac{25}{40}$ $\frac{5}{8}$, 5 $\frac{75}{100}$ $\frac{3}{4}$, 25

14. $\frac{16}{20}$ $\frac{4}{5}$, 4 $\frac{10}{12}$ $\frac{5}{6}$, 2 $\frac{24}{36}$ $\frac{2}{3}$, 12 $\frac{4}{18}$ $\frac{2}{9}$, 2 $\frac{10}{32}$ $\frac{5}{16}$, 2 $\frac{30}{60}$ $\frac{1}{2}$, 30 $\frac{60}{90}$ $\frac{2}{3}$, 30 $\frac{25}{50}$ $\frac{1}{2}$, 25 $\frac{35}{100}$ $\frac{7}{20}$, 5

Lead pupils to see that in multiplying terms of fraction by same number we make the size of the parts smaller, but there are more of them. Also, in changing fractions, the size of the parts is larger but there are fewer of them.

Kinds of Fractions



1. You see 1 whole pie and $\frac{3}{4}$ of another pie. The pies are cut into fourths. The pie on the right is less than 1 whole pie; it is $\frac{3}{4}$ of a pie. The fraction $\frac{3}{4}$, in which the numerator is less than the denominator, is a **proper fraction.** A proper fraction is less than 1 whole unit. Stress.

2. How many fourths of a pie do you see all together? The fraction $\frac{7}{4}$ shows more than 1 whole unit. The fraction $\frac{7}{4}$ is an **improper fraction.** How many fourths are there in 1 whole pie? The fraction $\frac{4}{4}$ is also an improper fraction. An improper fraction is equal to or larger than 1 whole unit. Stress.

3. You see $1\frac{3}{4}$ pies above. Numbers like $1\frac{3}{4}$, which are made of a whole number and a fraction, are **mixed numbers.** Stress.

4. To change an improper fraction to a whole number or to a mixed number, divide the numerator by the denominator. For example, $\frac{4}{4} = 4 \div 4 = 1$; $\frac{7}{4} = 7 \div 4 = 1\frac{3}{4}$; and $\frac{10}{4} = 10 \div 4 = 2\frac{1}{2}$.

Emphasize.

5. You know that $\frac{6}{1} = 6$. This shows that any whole number may be written in the form of a fraction with a denominator of 1. For example, 8 may be written as $\frac{8}{1}$. Tell how to write 3 in the form of a fraction. $\frac{3}{1}$

6. Tell which of the fractions below are proper (P) fractions and which are improper (I) fractions:

$\frac{2}{5}$ P $\frac{7}{7}$ I $\frac{10}{16}$ P $\frac{1}{2}$ P $\frac{12}{4}$ I $\frac{18}{5}$ I $\frac{12}{12}$ I $\frac{7}{12}$ P $\frac{14}{16}$ P

Change each fraction to a whole number or to a mixed number. Be sure that the fraction in the answer is in lowest terms: Stress.

7. $\frac{8}{8}$ 1 $\frac{10}{4}$ $2\frac{1}{2}$ $\frac{16}{8}$ 2 $\frac{12}{5}$ $2\frac{2}{5}$ $\frac{17}{12}$ $1\frac{5}{12}$ $\frac{24}{10}$ $2\frac{2}{5}$ $\frac{25}{25}$ 1 $\frac{18}{6}$ 3 $\frac{40}{12}$ $3\frac{1}{3}$

8. $\frac{9}{5}$ $1\frac{4}{5}$ $\frac{12}{6}$ 2 $\frac{12}{8}$ $1\frac{1}{2}$ $\frac{20}{8}$ $2\frac{1}{2}$ $\frac{20}{16}$ $1\frac{1}{4}$ $\frac{75}{24}$ $3\frac{1}{8}$ $\frac{80}{30}$ $2\frac{2}{3}$ $\frac{29}{6}$ $4\frac{5}{6}$ $\frac{66}{12}$ $5\frac{1}{2}$

9. $\frac{4}{2}$ 2 $\frac{25}{6}$ $4\frac{1}{6}$ $\frac{11}{8}$ $1\frac{3}{8}$ $\frac{15}{5}$ 3 $\frac{15}{10}$ $1\frac{1}{2}$ $\frac{28}{12}$ $2\frac{1}{3}$ $\frac{20}{15}$ $1\frac{1}{3}$ $\frac{20}{3}$ $6\frac{2}{3}$ $\frac{42}{16}$ $2\frac{5}{8}$

Give pupils further practice in distinguishing between proper and improper fractions and mixed numbers. Have pupils express other whole numbers in form of fractions (as in ex. 5). Stress reason "why" this can be done.

Adding Fractions

Review addition of like (pages 62–63) and unlike fractions (pages 64–65).

1. **Problem** At the candy store Jean bought $1\frac{1}{2}$ lb. of chocolate creams, $2\frac{1}{2}$ lb. of maple candy, and $1\frac{1}{2}$ lb. of molasses chips for a school party. How many pounds in all did she buy? $5\frac{1}{2}$

Explanation Since the fractions all have the same denominator, you add the fractions by adding the numerators. The sum is $\frac{3}{2}$. Change $\frac{3}{2}$ to $1\frac{1}{2}$; then add $1\frac{1}{2}$ to 4, which gives $5\frac{1}{2}$. Jean bought $5\frac{1}{2}$ lb. of candy.

Emphasize.

$$\begin{array}{r} 1\frac{1}{2} \\ 2\frac{1}{2} \\ 1\frac{1}{2} \\ \hline 4\frac{3}{2} = 5\frac{1}{2} \end{array}$$

2. Study these addition examples: Let volunteers explain these examples.

$$\begin{array}{r} \frac{1}{3} \\ \frac{1}{3} \\ \hline \frac{2}{3} \end{array} \qquad \begin{array}{r} 2\frac{1}{4} \\ 3\frac{1}{4} \\ \hline 5\frac{2}{4} = 5\frac{1}{2} \end{array} \qquad \begin{array}{r} \frac{5}{6} \\ \frac{1}{6} \\ \hline \frac{6}{6} = 1 \end{array} \qquad \begin{array}{r} 2\frac{9}{10} \\ 4\frac{7}{10} \\ \hline 6\frac{16}{10} = 7\frac{6}{10} = 7\frac{3}{5} \end{array}$$

Add. Check by going over your work: Be sure pupils change proper fractions to lowest terms, improper fractions to mixed numbers.

3.
$$\begin{array}{r} \frac{1}{5} \\ \frac{1}{5} \\ \hline \frac{2}{5} \end{array} \quad \begin{array}{r} \frac{1}{6} \\ \frac{1}{6} \\ \hline \frac{1}{3} \end{array} \quad \begin{array}{r} 2\frac{1}{2} \\ 3\frac{1}{2} \\ \hline 6 \end{array} \quad \begin{array}{r} 7\frac{1}{4} \\ \frac{1}{4} \\ \hline 7\frac{1}{2} \end{array} \quad \begin{array}{r} 5\frac{7}{12} \\ 2\frac{5}{12} \\ \hline 8 \end{array} \quad \begin{array}{r} 5\frac{2}{3} \\ 7\frac{2}{3} \\ \hline 13\frac{1}{3} \end{array} \quad \begin{array}{r} 1\frac{4}{9} \\ 2\frac{8}{9} \\ \hline 4\frac{1}{3} \end{array}$$

4.
$$\begin{array}{r} \frac{1}{8} \\ \frac{1}{8} \\ \hline \frac{1}{4} \end{array} \quad \begin{array}{r} \frac{3}{4} \\ \frac{1}{4} \\ \hline 1 \end{array} \quad \begin{array}{r} 4\frac{3}{4} \\ 1\frac{3}{4} \\ \hline 6\frac{1}{2} \end{array} \quad \begin{array}{r} 3\frac{7}{8} \\ 6\frac{5}{8} \\ \hline 10\frac{1}{2} \end{array} \quad \begin{array}{r} 2\frac{9}{10} \\ \frac{3}{10} \\ \hline 3\frac{1}{5} \end{array} \quad \begin{array}{r} 7\frac{7}{8} \\ 2\frac{3}{8} \\ \hline 10\frac{1}{4} \end{array} \quad \begin{array}{r} 5\frac{3}{8} \\ 1\frac{5}{8} \\ \hline 7 \end{array}$$

5.
$$\begin{array}{r} \frac{1}{8} \\ \frac{3}{8} \\ \frac{1}{8} \\ \hline \frac{5}{8} \end{array} \quad \begin{array}{r} \frac{1}{4} \\ \frac{3}{4} \\ \frac{1}{4} \\ \hline 1\frac{1}{4} \end{array} \quad \begin{array}{r} 2\frac{1}{4} \\ 3\frac{1}{4} \\ 1\frac{1}{4} \\ \hline 6\frac{3}{4} \end{array} \quad \begin{array}{r} 6\frac{1}{8} \\ 1\frac{3}{8} \\ \frac{3}{8} \\ \hline 7\frac{7}{8} \end{array} \quad \begin{array}{r} 2\frac{3}{16} \\ 4\frac{5}{16} \\ 1\frac{7}{16} \\ \hline 7\frac{15}{16} \end{array} \quad \begin{array}{r} 2\frac{1}{3} \\ 8\frac{2}{3} \\ 4\frac{1}{3} \\ \hline 15\frac{1}{3} \end{array} \quad \begin{array}{r} 4\frac{3}{4} \\ 2\frac{1}{4} \\ 6\frac{3}{4} \\ \hline 13\frac{3}{4} \end{array}$$

Emphasize that only like things can be added. Demonstrate some simple additions first (1 fourth + 2 fourths = 3 fourths, $\frac{1}{4} + \frac{2}{4} = \frac{3}{4}$). Then follow development as given on page.

Using Fractions

1. Mrs. Hunt bought two chickens at the store. One chicken weighed $2\frac{3}{4}$ lb. and the other weighed $3\frac{1}{4}$ lb. How much did both chickens weigh? 6 lb.

2. Ann bought $1\frac{3}{4}$ lb. of chocolate candy and $2\frac{3}{4}$ lb. of maple creams. How many pounds of candy did Ann buy? $4\frac{1}{2}$

3. Jim and his father drove $8\frac{3}{10}$ mi. to Bay City and then drove $6\frac{9}{10}$ mi. to Grandview. How many miles had they driven when they reached Grandview? $15\frac{2}{10}$, or $15\frac{1}{5}$

4. Bob works for Mr. Smith. Last week he worked $2\frac{1}{2}$ hr. on Wednesday afternoon and $4\frac{1}{2}$ hr. on Saturday. How many hours did Bob work that week? 7

5. Jean is going to help her mother bake two cakes for a party. For one cake they will need $\frac{5}{8}$ of a cup of butter and for the other cake they will need $\frac{7}{8}$ of a cup. How much butter do they need for these two cakes? $1\frac{1}{2}$ cups

6. In the basket on his bicycle John carried three packages to the post office. Their weights were $2\frac{3}{8}$ lb., $3\frac{7}{8}$ lb., and $1\frac{1}{8}$ lb. How many pounds did John carry in his basket? $7\frac{3}{8}$

Add. **Check by going over your work:**

7.	$\frac{2}{5}$ $\frac{3}{5}$ 1	$\frac{3}{8}$ $\frac{3}{8}$ $\frac{3}{4}$	$6\frac{1}{2}$ $\frac{1}{2}$ 7	$5\frac{9}{16}$ $2\frac{15}{16}$ $8\frac{1}{2}$	$8\frac{7}{10}$ $1\frac{3}{10}$ 10	$4\frac{11}{12}$ $9\frac{7}{12}$ $14\frac{1}{2}$	$3\frac{5}{6}$ $4\frac{5}{6}$ $8\frac{2}{3}$
8.	$\frac{5}{8}$ $\frac{7}{8}$ $1\frac{1}{2}$	$\frac{3}{4}$ $\frac{1}{4}$ 1	$8\frac{1}{3}$ $3\frac{1}{3}$ $11\frac{2}{3}$	$4\frac{7}{10}$ $4\frac{9}{10}$ $9\frac{3}{5}$	$3\frac{1}{12}$ $5\frac{7}{12}$ $8\frac{2}{3}$	$2\frac{3}{16}$ $2\frac{15}{16}$ $5\frac{1}{8}$	$7\frac{2}{3}$ $4\frac{2}{3}$ $12\frac{1}{3}$
9.	$\frac{2}{3}$ $\frac{2}{3}$ $1\frac{1}{3}$	$\frac{1}{8}$ $\frac{1}{8}$ $\frac{1}{4}$	$4\frac{1}{8}$ $2\frac{7}{8}$ 7	$3\frac{5}{16}$ $4\frac{7}{16}$ $7\frac{3}{4}$	$8\frac{15}{16}$ $9\frac{13}{16}$ $18\frac{3}{4}$	$4\frac{7}{12}$ $3\frac{11}{12}$ $8\frac{1}{2}$	$1\frac{1}{2}$ $4\frac{1}{2}$ 6
10.	$\frac{1}{4}$ $\frac{3}{4}$ $\frac{3}{4}$ $1\frac{3}{4}$	$\frac{1}{6}$ $\frac{5}{6}$ $\frac{5}{6}$ $1\frac{5}{6}$	$2\frac{3}{4}$ $4\frac{3}{4}$ $8\frac{3}{4}$ $16\frac{1}{4}$	$7\frac{3}{10}$ $6\frac{7}{10}$ $2\frac{9}{10}$ $16\frac{9}{10}$	$2\frac{1}{16}$ $7\frac{3}{16}$ $5\frac{5}{16}$ $14\frac{9}{16}$	$1\frac{3}{10}$ $5\frac{1}{10}$ $7\frac{7}{10}$ $14\frac{1}{10}$	$2\frac{2}{5}$ $1\frac{3}{5}$ $6\frac{4}{5}$ $10\frac{4}{5}$

Be sure pupils include sum of whole numbers in complete answer, where sum of fractions is mixed number. Emphasize that only numerators are added, since denominators give name of fractions.

Adding Fractions

1. Problem Peter walked $\frac{3}{4}$ mi. to school, $1\frac{1}{2}$ mi. to the swimming pool, and then $1\frac{1}{8}$ mi. to get home. How many miles in all did Peter walk? $3\frac{3}{8}$

$$\begin{array}{rcl} \frac{3}{4} & = & \frac{6}{8} \\ 1\frac{1}{2} & = & 1\frac{4}{8} \\ \underline{1\frac{1}{8}} & = & \underline{1\frac{1}{8}} \\ & & 2\frac{11}{8} = 3\frac{3}{8} \end{array}$$

Explanation You cannot add **halves, fourths,** and **eighths** because fractions that you add must have like denominators. You can add $\frac{3}{4}$, $\frac{1}{2}$, and $\frac{1}{8}$ if you change them all to **eighths,** as shown at the right. The sum of the fractions is $\frac{11}{8}$. Change $\frac{11}{8}$ to $1\frac{3}{8}$; then add $1\frac{3}{8}$ to 2, which gives $3\frac{3}{8}$. Peter walked $3\frac{3}{8}$ mi.

Demonstrate and emphasize.

To add fractions with unlike denominators, first change them to fractions with like denominators.

2. Study these addition examples: Discuss examples thoroughly with pupils.

$$\begin{array}{rcl} 2\frac{5}{12} & = & 2\frac{5}{12} \\ \underline{7\frac{1}{4}} & = & \underline{7\frac{3}{12}} \\ & & 9\frac{8}{12} = 9\frac{2}{3} \end{array} \qquad \begin{array}{rcl} 4\frac{2}{3} & = & 4\frac{4}{6} \\ \underline{1\frac{5}{6}} & = & \underline{1\frac{5}{6}} \\ & & 5\frac{9}{6} = 6\frac{3}{6} = 6\frac{1}{2} \end{array} \qquad \begin{array}{rcl} 1\frac{2}{3} & = & 1\frac{8}{12} \\ \underline{3\frac{1}{4}} & = & \underline{3\frac{3}{12}} \\ & & 4\frac{11}{12} \end{array}$$

Add. Check by going over your work: Be sure pupils do work as in ex. 1–2.

3.

$$\begin{array}{rrrrrrr} 6\frac{1}{4} & 7\frac{9}{16} & 7 & 5\frac{7}{16} & 2\frac{5}{12} & 4\frac{9}{16} & 8\frac{1}{3} \\ \underline{3\frac{1}{2}} & \underline{3\frac{1}{4}} & \underline{4\frac{3}{8}} & \underline{9\frac{3}{8}} & \underline{4\frac{1}{6}} & \underline{6\frac{5}{8}} & \underline{7\frac{1}{2}} \\ 9\frac{3}{4} & 10\frac{13}{16} & 11\frac{3}{8} & 14\frac{13}{16} & 6\frac{7}{12} & 11\frac{3}{16} & 15\frac{5}{6} \end{array}$$

4.

$$\begin{array}{rrrrrrr} 3\frac{1}{4} & 3\frac{3}{16} & 2\frac{1}{2} & 6\frac{4}{5} & 7\frac{5}{8} & 5\frac{7}{12} & 7\frac{1}{2} \\ \underline{4\frac{5}{8}} & \underline{2\frac{7}{8}} & \underline{4\frac{1}{3}} & \underline{1\frac{7}{10}} & \underline{4\frac{3}{16}} & \underline{2\frac{3}{4}} & \underline{2\frac{2}{3}} \\ 7\frac{7}{8} & 6\frac{1}{16} & 6\frac{5}{6} & 8\frac{1}{2} & 11\frac{13}{16} & 8\frac{1}{3} & 10\frac{1}{6} \end{array}$$

5.

$$\begin{array}{rrrrrrr} 5\frac{1}{6} & 7\frac{2}{3} & 8\frac{5}{8} & 2\frac{9}{16} & 3\frac{7}{10} & 2\frac{3}{4} & 2\frac{1}{3} \\ 3\frac{1}{2} & 4\frac{7}{12} & 3\frac{1}{4} & 4\frac{1}{2} & 1\frac{4}{5} & 5\frac{1}{8} & 4\frac{1}{3} \\ \underline{2\frac{1}{3}} & \underline{1\frac{1}{2}} & \underline{5\frac{1}{2}} & \underline{7\frac{3}{16}} & \underline{2\frac{1}{2}} & \underline{7\frac{9}{16}} & \underline{5\frac{1}{6}} \\ 11 & 13\frac{3}{4} & 17\frac{3}{8} & 14\frac{1}{4} & 8 & 15\frac{7}{16} & 11\frac{5}{6} \end{array}$$

More Practice. See ⑬ on page 314.

Use flannelboard and fractional parts in discussing ex. 1. Have pupils explain why fractions were changed to eighths (and not fourths or halves). Emphasize fact that fractions must have same denominator before they can be added.

Problems and Practice

1. Nancy and Judy are making three costumes for the school play. For trimming the costumes they used red ribbon of these lengths: $2\frac{3}{8}$ yd., $\frac{1}{2}$ yd., $\frac{3}{4}$ yd. How much red ribbon did the girls buy? $3\frac{5}{8}$ yd.

2. Mary's mother bought two packages of cheese. One weighed $1\frac{1}{4}$ lb. and the other weighed $1\frac{1}{2}$ lb. How much did both packages of cheese weigh? $2\frac{3}{4}$ lb.

3. Ted is going to make the top of a bench out of three boards with widths of $3\frac{5}{16}$ in., $4\frac{1}{2}$ in., and $3\frac{1}{4}$ in. He will place them side by side. How wide will the top of the bench be? $11\frac{1}{16}$ in.

Add and check: Have pupils explain work at blackboard.

4.	$\frac{1}{8}$	$2\frac{5}{12}$	$6\frac{3}{4}$	$2\frac{3}{5}$	$4\frac{5}{12}$	$3\frac{7}{16}$	$6\frac{11}{16}$
	$\frac{7}{8}$	$7\frac{1}{4}$	$3\frac{2}{3}$	$2\frac{3}{10}$	$2\frac{5}{6}$	$9\frac{7}{8}$	$8\frac{3}{16}$
	1	$9\frac{2}{3}$	$10\frac{5}{12}$	$4\frac{9}{10}$	$7\frac{1}{4}$	$13\frac{5}{16}$	$14\frac{7}{8}$
5.	$\frac{2}{3}$	$1\frac{2}{3}$	$3\frac{3}{4}$	$2\frac{1}{2}$	$2\frac{7}{10}$	$5\frac{7}{8}$	$4\frac{3}{10}$
	$\frac{5}{6}$	$6\frac{1}{12}$	$4\frac{7}{8}$	$4\frac{3}{10}$	$7\frac{1}{5}$	$2\frac{11}{16}$	$8\frac{1}{2}$
	$1\frac{1}{2}$	$7\frac{3}{4}$	$8\frac{5}{8}$	$6\frac{4}{5}$	$9\frac{9}{10}$	$8\frac{9}{16}$	$12\frac{4}{5}$
6.	$\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{3}{8}$	$4\frac{1}{2}$	$6\frac{3}{4}$	$3\frac{1}{5}$	$2\frac{7}{16}$
	$\frac{1}{2}$	$5\frac{5}{6}$	$\frac{3}{8}$	$4\frac{4}{5}$	$2\frac{3}{8}$	$2\frac{3}{10}$	$1\frac{3}{8}$
	$\frac{5}{8}$	$1\frac{11}{12}$	$8\frac{7}{8}$	$5\frac{9}{10}$	$4\frac{7}{16}$	$1\frac{1}{2}$	$1\frac{3}{4}$
	$1\frac{5}{8}$	$9\frac{1}{4}$	$11\frac{5}{8}$	$15\frac{1}{5}$	$13\frac{9}{16}$	7	$5\frac{9}{16}$
7.	$\frac{7}{8}$	$3\frac{11}{16}$	$8\frac{1}{8}$	$7\frac{11}{12}$	$2\frac{3}{4}$	$6\frac{1}{3}$	$2\frac{9}{10}$
	$\frac{7}{8}$	$7\frac{3}{16}$	$1\frac{1}{2}$	$4\frac{5}{6}$	$4\frac{7}{16}$	$5\frac{3}{4}$	$7\frac{9}{10}$
	$\frac{5}{8}$	$4\frac{1}{16}$	$7\frac{1}{4}$	$1\frac{1}{3}$	$4\frac{1}{2}$	$8\frac{7}{12}$	$4\frac{3}{5}$
	$2\frac{3}{8}$	$14\frac{15}{16}$	$16\frac{7}{8}$	$14\frac{1}{12}$	$11\frac{11}{16}$	$20\frac{2}{3}$	$15\frac{2}{5}$

Have more advanced pupils make up original problems about weight, distance, time, and so on, using numbers in ex. 4–5.

Review subtraction of fractions where there is no regrouping.

Subtracting Fractions

1. **Problem** Ann has a piece of cloth $2\frac{3}{4}$ yd. long. If she makes a skirt that takes $1\frac{1}{2}$ yd., how much cloth will be left? $1\frac{1}{4}$ yd.

Explanation You cannot subtract $\frac{1}{2}$ from $\frac{3}{4}$ as they stand because these fractions have different denominators. Change $\frac{1}{2}$ to $\frac{2}{4}$; then subtract $\frac{2}{4}$ from $\frac{3}{4}$. Ann will have $1\frac{1}{4}$ yd. of cloth left.

$$\begin{array}{rcr} 2\frac{3}{4} & = & 2\frac{3}{4} \\ \underline{1\frac{1}{2}} & = & \underline{1\frac{2}{4}} \\ & & 1\frac{1}{4} \end{array}$$

2. Bob agreed to work in the garden $6\frac{1}{2}$ hr. this week. By Thursday night he had worked $3\frac{1}{4}$ hr. How many more hours does Bob have to work this week? $3\frac{1}{4}$

3. Dick weighs $88\frac{3}{4}$ lb. and Tony weighs $86\frac{1}{8}$ lb. How many more pounds does Dick weigh than Tony? $2\frac{5}{8}$

Let less capable pupils use fractional parts or diagrams in ex. 4–5.

Subtract. Check by going over your work:

4. $\frac{3}{4} - \frac{1}{4}$ $\frac{1}{2}$ $\frac{9}{10} - \frac{3}{10}$ $\frac{3}{5}$ $\frac{1}{2} - \frac{1}{8}$ $\frac{3}{8}$ $\frac{5}{6} - \frac{5}{12}$ $\frac{5}{12}$ $\frac{7}{8} - \frac{1}{2}$ $\frac{3}{8}$

5. $\frac{7}{8} - \frac{1}{8}$ $\frac{3}{4}$ $\frac{11}{16} - \frac{3}{16}$ $\frac{1}{2}$ $\frac{1}{2} - \frac{1}{4}$ $\frac{1}{4}$ $\frac{5}{8} - \frac{3}{16}$ $\frac{7}{16}$ $\frac{2}{3} - \frac{1}{2}$ $\frac{1}{6}$

6.	$\begin{array}{r}3\frac{3}{4}\\ \underline{1\frac{1}{4}}\\ 2\frac{1}{2}\end{array}$	$\begin{array}{r}4\frac{13}{16}\\ \underline{1\frac{9}{16}}\\ 3\frac{1}{4}\end{array}$	$\begin{array}{r}9\frac{5}{6}\\ \underline{4\frac{1}{6}}\\ 5\frac{2}{3}\end{array}$	$\begin{array}{r}6\frac{7}{10}\\ \underline{3\frac{1}{2}}\\ 3\frac{1}{5}\end{array}$	$\begin{array}{r}4\frac{9}{10}\\ \underline{2\frac{3}{5}}\\ 2\frac{3}{10}\end{array}$	$\begin{array}{r}2\frac{1}{2}\\ \underline{1\frac{1}{3}}\\ 1\frac{1}{6}\end{array}$	$\begin{array}{r}7\frac{5}{8}\\ \underline{\frac{3}{8}}\\ 7\frac{1}{4}\end{array}$
7.	$\begin{array}{r}2\frac{7}{8}\\ \underline{1\frac{1}{8}}\\ 1\frac{3}{4}\end{array}$	$\begin{array}{r}6\frac{7}{16}\\ \underline{2\frac{3}{16}}\\ 4\frac{1}{4}\end{array}$	$\begin{array}{r}5\frac{7}{8}\\ \underline{3\frac{1}{4}}\\ 2\frac{5}{8}\end{array}$	$\begin{array}{r}4\frac{15}{16}\\ \underline{1\frac{1}{4}}\\ 3\frac{11}{16}\end{array}$	$\begin{array}{r}7\frac{3}{5}\\ \underline{2\frac{1}{10}}\\ 5\frac{1}{2}\end{array}$	$\begin{array}{r}6\frac{1}{2}\\ \underline{4\frac{1}{5}}\\ 2\frac{3}{10}\end{array}$	$\begin{array}{r}5\frac{2}{3}\\ \underline{2\frac{1}{6}}\\ 3\frac{1}{2}\end{array}$
8.	$\begin{array}{r}4\frac{7}{8}\\ \underline{4\frac{3}{4}}\\ \frac{1}{8}\end{array}$	$\begin{array}{r}7\frac{7}{12}\\ \underline{1\frac{5}{12}}\\ 6\frac{1}{6}\end{array}$	$\begin{array}{r}5\frac{2}{3}\\ \underline{1\frac{1}{4}}\\ 4\frac{5}{12}\end{array}$	$\begin{array}{r}6\frac{7}{16}\\ \underline{4\frac{1}{8}}\\ 2\frac{5}{16}\end{array}$	$\begin{array}{r}7\frac{11}{12}\\ \underline{4\frac{5}{12}}\\ 3\frac{1}{2}\end{array}$	$\begin{array}{r}5\frac{2}{3}\\ \underline{1\frac{1}{2}}\\ 4\frac{1}{6}\end{array}$	$\begin{array}{r}2\frac{3}{4}\\ \underline{2\frac{5}{8}}\\ \frac{1}{8}\end{array}$
9.	$\begin{array}{r}7\frac{3}{5}\\ \underline{2\frac{1}{2}}\\ 5\frac{1}{10}\end{array}$	$\begin{array}{r}2\frac{7}{16}\\ \underline{\frac{3}{8}}\\ 2\frac{1}{16}\end{array}$	$\begin{array}{r}5\frac{3}{4}\\ \underline{1\frac{1}{3}}\\ 4\frac{5}{12}\end{array}$	$\begin{array}{r}6\frac{1}{2}\\ \underline{4\frac{5}{12}}\\ 2\frac{1}{12}\end{array}$	$\begin{array}{r}7\frac{4}{5}\\ \underline{3\frac{7}{10}}\\ 4\frac{1}{10}\end{array}$	$\begin{array}{r}9\frac{3}{8}\\ \underline{2\frac{1}{4}}\\ 7\frac{1}{8}\end{array}$	$\begin{array}{r}5\frac{1}{3}\\ \underline{3\frac{1}{6}}\\ 2\frac{1}{6}\end{array}$
10.	$\begin{array}{r}4\frac{1}{2}\\ \underline{\frac{3}{8}}\\ 4\frac{1}{8}\end{array}$	$\begin{array}{r}8\frac{1}{2}\\ \underline{7\frac{3}{10}}\\ 1\frac{1}{5}\end{array}$	$\begin{array}{r}8\frac{1}{2}\\ \underline{4\frac{1}{2}}\\ 4\end{array}$	$\begin{array}{r}7\frac{15}{16}\\ \underline{2\frac{1}{2}}\\ 5\frac{7}{16}\end{array}$	$\begin{array}{r}9\frac{1}{2}\\ \underline{2\frac{1}{12}}\\ 7\frac{5}{12}\end{array}$	$\begin{array}{r}8\frac{3}{4}\\ \underline{1\frac{2}{3}}\\ 7\frac{1}{12}\end{array}$	$\begin{array}{r}5\frac{1}{2}\\ \underline{1\frac{1}{8}}\\ 4\frac{3}{8}\end{array}$

More Practice. See ⑭ on page 315.

Use flannelboard and fractional parts to demonstrate in ex. 1. Emphasize that denominators must be same in order to subtract fractions. Do ex. 1–3 with pupils.

Present first set of improvement tests in subtraction of whole numbers.

Improving by Practice

Subtraction Test 1a.

Time: 4 min.

1.	5689	8793	8761	4080	5549	
	3462	2649	1896	3245	4196	
	2227	6144	6865	835	1353	
2.	3306	3476	7204	6458	4000	
	1737	1219	5244	5569	2496	
	1569	2257	1960	889	1504	
3.	5268	8000	8037	7041	6365	
	3325	5817	2583	3743	1578	⑮
	1943	2183	5454	3298	4787	

Subtraction Test 1b.

Time: 4 min.

4.	5878	7822	6623	4278	2538	
	2371	4718	2657	1449	2368	
	3507	3104	3966	2829	170	
5.	7337	4564	9716	5521	3464	
	2698	1348	4746	4889	1532	
	4639	3216	4970	632	1932	
6.	7151	8088	8000	6604	9000	
	5977	5152	3248	1636	7573	⑮
	1174	2936	4752	4968	1427	

Subtraction Test 1c.

Time: 4 min.

7.	3957	3867	9135	8607	5424	
	2652	3319	6579	1241	3479	
	1305	548	2556	7366	1945	
8.	7322	3080	8643	7000	6307	
	4436	2367	7756	2586	4387	
	2886	713	887	4414	1920	
9.	4498	3278	7000	8082	2242	
	3514	1699	5627	5385	1298	⑮
	984	1579	1373	2697	944	

To the Teacher. The Improvement Tests above are to be given to the pupils on three different days. See page 328 for the procedure to follow.

See suggestions and instructions on pages 54–58 and G-30, 31. Be sure pupils do not sacrifice accuracy for speed. Hold individual conferences before assigning remedial work.

Review subtraction of fractions in which fraction in minuend is less than fraction in subtrahend (pages 68–71).

Preparing to Subtract Fractions

1. Today at the bank Betsy had $\$5$ changed into 4 dollars and 10 dimes. Does $\$5 = \$4\frac{10}{10}$? Yes

2. Tom had 3 dollars and 4 dimes. If he changed 1 dollar into dimes, how many dollars and dimes did he have then? Does $\$3\frac{4}{10} = \$2\frac{14}{10}$? Yes 2 dollars and 14 dimes

3. Susan had 4 dollars and 3 quarters. If she changed 1 dollar into quarters, how many dollars and quarters did she have then? Does $\$4\frac{3}{4} = \$3\frac{7}{4}$? Yes
3 dollars and 7 quarters

4. Mr. Stone had 3 dollars and 1 half dollar. If he changed 1 dollar into half dollars, how many dollars and half dollars did he have then? Does $\$3\frac{1}{2} = \$2\frac{3}{2}$? Yes
2 dollars and 3 half dollars

5. Henry had 8 dollars and 1 half dollar. If he changed the half dollar and 1 dollar into dimes, how many dollars and dimes did he have then? Does $\$8\frac{1}{2} = \$8\frac{5}{10} = \$7\frac{15}{10}$? Yes
7 dollars and 15 half dollars

Tell what numbers go in the spaces and in the numerators:

6. $\$5$ equals $\$4$ and . .4. quarters. $5 = 4\frac{?}{4}$ 4

7. $\$7$ equals $\$6$ and . .2. half dollars. $7 = 6\frac{?}{2}$ 2

8. $\$10$ equals $\$9$ and . .10. dimes. $10 = 9\frac{?}{10}$ 10

9. $\$5\frac{1}{4}$ equals $\$4$ and . .5. quarters. $5\frac{1}{4} = 4\frac{?}{4}$ 5

10. $\$2\frac{1}{2}$ equals $\$1$ and . .3. half dollars. $2\frac{1}{2} = 1\frac{?}{2}$ 3

11. $\$7\frac{1}{2}$ equals $\$6$ and . .15. dimes. $7\frac{1}{2} = 6\frac{?}{10}$ 15

12. $\$3\frac{1}{2}$ equals $\$2$ and . .6. quarters. $3\frac{1}{2} = 2\frac{?}{4}$ 6

13. $3 = 2\frac{?}{4}$ 4 $3\frac{1}{6} = 2\frac{?}{6}$ 7 $9\frac{1}{12} = 8\frac{?}{12}$ 13 $8\frac{2}{3} = 8\frac{4}{6} = 7\frac{?}{6}$ 10

14. $7 = 6\frac{?}{2}$ 2 $6\frac{7}{8} = 5\frac{?}{8}$ 15 $3\frac{5}{16} = 2\frac{?}{16}$ 21 $4\frac{1}{2} = 4\frac{4}{8} = 3\frac{?}{8}$ 12

15. $5 = 4\frac{?}{3}$ 3 $8\frac{3}{5} = 7\frac{?}{5}$ 8 $6\frac{3}{10} = 5\frac{?}{10}$ 13 $7\frac{3}{4} = 7\frac{?}{8}$ 6 $= 6\frac{?}{8}$ 14

16. $2 = 1\frac{?}{8}$ 8 $7\frac{1}{4} = 6\frac{?}{4}$ 5 $5\frac{9}{16} = 4\frac{?}{16}$ 25 $3\frac{1}{2} = 3\frac{?}{10}$ 5 $= 2\frac{?}{10}$ 15

17. $4 = 3\frac{?}{10}$ 10 $9\frac{1}{3} = 8\frac{?}{3}$ 4 $6\frac{5}{12} = 5\frac{?}{12}$ 17 $5\frac{1}{4} = 5\frac{?}{12}$ 3 $= 4\frac{?}{12}$ 15

More Practice. See ⑮ on page 315.

Follow development as given in ex. 1–12. Then review, using materials, number of fourths, thirds, and so on, in 1 whole. Do some simple examples ($2 = 1\frac{2}{2}$, $1\frac{1}{4} = \frac{5}{4}$, and so on) and let pupils use materials or diagrams to prove answers.

Going Fishing

1. **Problem** Dan and Tom went on an all-day fishing trip to Lake Pleasant. The distance to the lake was 10 mi. They took a bus for $8\frac{1}{2}$ mi. and walked the rest of the way. How far did they have to walk to reach Lake Pleasant? $1\frac{1}{2}$ mi.

Explanation To subtract a mixed number from 10 you must first change 10 to $9\frac{2}{2}$. Then you can subtract $\frac{1}{2}$ from $\frac{2}{2}$, which gives $\frac{1}{2}$, and 8 from 9. The boys had to walk $1\frac{1}{2}$ mi.

$$\begin{array}{rcr} 10 & = & 9\frac{2}{2} \\ \underline{8\frac{1}{2}} & = & \underline{8\frac{1}{2}} \\ & & 1\frac{1}{2} \end{array}$$

2. **Problem** The first fish Dan caught weighed $2\frac{1}{4}$ lb. and the first fish Tom caught weighed $1\frac{3}{4}$ lb. What is the difference in the weights of these two fish? $\frac{1}{2}$ lb.

Explanation Since you cannot subtract $\frac{3}{4}$ from $\frac{1}{4}$, change $2\frac{1}{4}$ to $1\frac{5}{4}$. Then you can subtract $\frac{3}{4}$ from $\frac{5}{4}$ and 1 from 1. This gives $\frac{2}{4}$, which can be changed to $\frac{1}{2}$. The difference in the weights of the fish is $\frac{1}{2}$ lb.

$$\begin{array}{rcr} 2\frac{1}{4} & = & 1\frac{5}{4} \\ \underline{1\frac{3}{4}} & = & \underline{1\frac{3}{4}} \\ & & \frac{2}{4} = \frac{1}{2} \end{array}$$

3. During the day Dan caught fish weighing a total of $8\frac{3}{4}$ lb. and Tom caught fish weighing a total of $11\frac{1}{4}$ lb. How much more did Tom's catch weigh than Dan's? $2\frac{1}{2}$ lb.

4. Study these subtraction examples: Have pupils explain them.

$$\begin{array}{rcr} 1 & = & \frac{4}{4} \\ \underline{\frac{3}{4}} & = & \underline{\frac{3}{4}} \\ & & \frac{1}{4} \end{array} \qquad \begin{array}{rcr} 8 & = & 7\frac{6}{6} \\ \underline{2\frac{1}{6}} & = & \underline{2\frac{1}{6}} \\ & & 5\frac{5}{6} \end{array} \qquad \begin{array}{rcr} 5\frac{1}{3} & = & 4\frac{4}{3} \\ \underline{1\frac{2}{3}} & = & \underline{1\frac{2}{3}} \\ & & 3\frac{2}{3} \end{array} \qquad \begin{array}{rcr} 6\frac{1}{8} & = & 5\frac{9}{8} \\ \underline{2\frac{5}{8}} & = & \underline{2\frac{5}{8}} \\ & & 3\frac{4}{8} = 3\frac{1}{2} \end{array}$$

Have pupils show work as in ex. 1-2.

Subtract. Check by going over your work:

5.

$$\begin{array}{ccccccc} 8\frac{1}{4} & 1 & 5\frac{3}{8} & 7 & 7\frac{3}{16} & 4 & 8\frac{5}{12} \\ \underline{5\frac{3}{4}} & \underline{\frac{2}{3}} & \underline{2\frac{7}{8}} & \underline{\frac{1}{2}} & \underline{2\frac{5}{16}} & \underline{\frac{3}{4}} & \underline{1\frac{11}{12}} \\ 2\frac{1}{2} & \frac{1}{3} & 2\frac{1}{2} & 6\frac{1}{2} & 4\frac{7}{8} & 3\frac{1}{4} & 6\frac{1}{2} \end{array}$$

More Practice. See ⑯ on page 315. Use for individual assistance.

Emphasize reason for exchange of whole unit for a particular unit: if we are subtracting halves, the 1 must be changed to $\frac{2}{2}$, and so on. Insist that pupils show true equality and explain why $10 = 9\frac{2}{2}$.

How Much Have They Grown?

1. **Problem** Don was $56\frac{1}{2}$ in. tall in June. In September he was $58\frac{1}{4}$ in. tall. How many inches did he grow in 3 mo.? $1\frac{3}{4}$

Explanation You must change $56\frac{1}{2}$ to $56\frac{2}{4}$ so that both fractions will have the same denominator. But you cannot subtract $\frac{2}{4}$ from $\frac{1}{4}$, so you must also change $58\frac{1}{4}$ to $57\frac{5}{4}$. Now subtract $56\frac{2}{4}$ from $57\frac{5}{4}$. Don grew $1\frac{3}{4}$ in.

$$\begin{array}{rcr}
58\frac{1}{4} & = & 57\frac{5}{4} \\
\underline{56\frac{1}{2}} & = & \underline{56\frac{2}{4}} \\
 & & 1\frac{3}{4}
\end{array}$$

2. **Problem** Don weighed $83\frac{5}{8}$ lb. in June. In September he weighed $87\frac{1}{2}$ lb. How many pounds did he gain during the summer? $3\frac{7}{8}$

Explanation **Eighths** and **halves** do not have the same denominator, so you must change $87\frac{1}{2}$ to $87\frac{4}{8}$. But you cannot subtract $\frac{5}{8}$ from $\frac{4}{8}$, so you must also change $87\frac{4}{8}$ to $86\frac{12}{8}$. Then subtract $83\frac{5}{8}$ from $86\frac{12}{8}$. Don gained $3\frac{7}{8}$ lb.

$$\begin{array}{rcrcr}
87\frac{1}{2} & = & 87\frac{4}{8} & = & 86\frac{12}{8} \\
\underline{83\frac{5}{8}} & = & \underline{83\frac{5}{8}} & = & \underline{83\frac{5}{8}} \\
 & & & & 3\frac{7}{8}
\end{array}$$

3. Don's sister Peggy was $54\frac{3}{4}$ in. tall in June. In September she was $55\frac{1}{2}$ in. tall. How many inches taller was Peggy in September than in June? $\frac{3}{4}$

Subtract. Check the work by going over it: Have pupils show work in ex. 5 as in ex. 1–2.

$$\begin{array}{lrrrrrrr}
\textbf{4.} & 9\frac{1}{6} & 7\frac{1}{5} & 8\frac{1}{2} & 6\frac{2}{5} & 8\frac{1}{4} & 2\frac{5}{12} & 7\frac{1}{2} \\
 & \underline{3\frac{1}{2}} & \underline{1\frac{7}{10}} & \underline{7\frac{7}{12}} & \underline{2\frac{1}{2}} & \underline{1\frac{7}{8}} & \underline{1\frac{2}{3}} & \underline{4\frac{2}{3}} \\
 & 5\frac{2}{3} & 5\frac{1}{2} & \frac{11}{12} & 3\frac{9}{10} & 6\frac{3}{8} & \frac{3}{4} & 2\frac{5}{6} \\
\textbf{5.} & 3\frac{1}{4} & 8\frac{1}{8} & 4\frac{3}{16} & 7\frac{1}{8} & 8 & 8\frac{1}{4} & 6 \\
 & \underline{2\frac{1}{2}} & \underline{6\frac{3}{16}} & \underline{2\frac{1}{2}} & \underline{3\frac{1}{2}} & \underline{2\frac{2}{3}} & \underline{5\frac{5}{16}} & \underline{\frac{5}{6}} \\
 & \frac{3}{4} & 1\frac{15}{16} & 1\frac{11}{16} & 3\frac{5}{8} & 5\frac{1}{3} & 2\frac{15}{16} & 5\frac{1}{6} \\
\textbf{6.} & 4\frac{3}{4} & 5\frac{7}{10} & 4\frac{3}{4} & 5\frac{1}{2} & 7\frac{1}{3} & 8\frac{7}{16} & 6\frac{1}{8} \\
 & \underline{\frac{7}{8}} & \underline{4\frac{4}{5}} & \underline{1\frac{5}{12}} & \underline{2\frac{3}{4}} & \underline{3\frac{5}{6}} & \underline{1\frac{3}{4}} & \underline{2\frac{3}{4}} \\
 & 3\frac{7}{8} & \frac{9}{10} & 3\frac{1}{3} & 2\frac{3}{4} & 3\frac{1}{2} & 6\frac{11}{16} & 3\frac{3}{8} \\
\textbf{7.} & 5\frac{1}{3} & 6\frac{1}{4} & 4\frac{1}{2} & 9\frac{1}{2} & 5\frac{1}{2} & 4\frac{1}{2} & 2\frac{1}{2} \\
 & \underline{3\frac{3}{4}} & \underline{2\frac{7}{16}} & \underline{\frac{13}{16}} & \underline{4\frac{7}{8}} & \underline{3\frac{5}{6}} & \underline{3\frac{7}{10}} & \underline{1\frac{4}{5}} \\
 & 1\frac{7}{12} & 3\frac{13}{16} & 3\frac{11}{16} & 4\frac{5}{8} & 1\frac{2}{3} & \frac{4}{5} & \frac{7}{10}
\end{array}$$

Be sure pupils understand why $\frac{1}{2}$ was changed to $\frac{2}{4}$ (fraction can always be changed to higher terms, but not always to lower ones). Have pupils explain work in ex. 4–7.

How Fast Can You Swim?

1. Bob can swim 50 yd. in $34\frac{4}{5}$ sec. Jack can swim the same distance in $37\frac{1}{10}$ sec. How much less time does it take Bob than Jack? $2\frac{3}{10}$ sec.

2. Bob read in the paper that the record time for swimming 50 yd. in the High School Meet was $23\frac{9}{10}$ sec. How much less is this time than Bob's time? $10\frac{9}{10}$ sec. than Jack's time? $13\frac{1}{5}$ sec.

3. Mary can swim 25 yd. in $19\frac{1}{2}$ sec. and Ann can swim this distance in $17\frac{7}{10}$ sec. How much longer does it take Mary than Ann to swim 25 yd.? $1\frac{4}{5}$ sec.

Subtract. Check by going over your work: Have pupils show work as in ex. 1–2 on page 70.

4.	$8\frac{3}{16}$	$4\frac{1}{8}$	5	$8\frac{3}{4}$	$7\frac{1}{8}$	$3\frac{1}{16}$	$7\frac{1}{12}$
	$2\frac{7}{16}$	$1\frac{7}{8}$	$\frac{3}{8}$	$1\frac{1}{16}$	$2\frac{3}{8}$	$2\frac{3}{4}$	$2\frac{1}{3}$
	$5\frac{3}{4}$	$2\frac{1}{4}$	$4\frac{5}{8}$	$7\frac{11}{16}$	$4\frac{3}{4}$	$\frac{5}{16}$	$4\frac{3}{4}$
5.	$6\frac{5}{12}$	$7\frac{5}{8}$	$5\frac{1}{2}$	1	$9\frac{1}{8}$	$6\frac{1}{2}$	$4\frac{3}{10}$
	$1\frac{3}{4}$	$2\frac{7}{8}$	$1\frac{2}{3}$	$\frac{5}{12}$	$2\frac{1}{2}$	$3\frac{9}{16}$	$1\frac{1}{2}$
	$4\frac{2}{3}$	$4\frac{3}{4}$	$3\frac{5}{6}$	$\frac{7}{12}$	$6\frac{5}{8}$	$2\frac{15}{16}$	$2\frac{4}{5}$
6.	$4\frac{13}{16}$	$5\frac{1}{4}$	8	$1\frac{1}{5}$	$4\frac{1}{4}$	$7\frac{1}{6}$	$9\frac{1}{6}$
	$2\frac{7}{8}$	$3\frac{1}{3}$	$6\frac{1}{6}$	$\frac{9}{10}$	$1\frac{1}{2}$	$3\frac{11}{12}$	$4\frac{7}{12}$
	$1\frac{15}{16}$	$1\frac{11}{12}$	$1\frac{5}{6}$	$\frac{3}{10}$	$2\frac{3}{4}$	$3\frac{1}{4}$	$4\frac{7}{12}$
7.	$9\frac{1}{10}$	$7\frac{1}{4}$	$5\frac{3}{8}$	$4\frac{3}{10}$	$9\frac{1}{6}$	$3\frac{1}{2}$	$5\frac{1}{4}$
	$4\frac{1}{2}$	$2\frac{5}{8}$	$2\frac{5}{8}$	$3\frac{2}{5}$	$4\frac{2}{3}$	$2\frac{11}{12}$	$2\frac{9}{16}$
	$4\frac{3}{5}$	$4\frac{5}{8}$	$2\frac{3}{4}$	$\frac{9}{10}$	$4\frac{1}{2}$	$\frac{7}{12}$	$2\frac{11}{16}$
8.	$8\frac{1}{2}$	$4\frac{1}{5}$	$6\frac{1}{3}$	$2\frac{5}{8}$	$8\frac{1}{5}$	$8\frac{1}{3}$	$7\frac{1}{16}$
	$6\frac{5}{12}$	$3\frac{1}{2}$	$2\frac{7}{8}$	$1\frac{15}{16}$	$6\frac{4}{5}$	$6\frac{11}{12}$	$2\frac{3}{4}$
	$2\frac{1}{12}$	$\frac{7}{10}$	$3\frac{11}{24}$	$\frac{11}{16}$	$1\frac{2}{5}$	$1\frac{5}{12}$	$4\frac{15}{16}$

Do ex. 1–3 with pupils. Let them do ex. 4–8 independently. Group pupils who had mistakes to help them analyze causes. Have them explain their work so you can check understandings.

Three-Step Problems

1. Problem Jim is earning money to buy a bicycle costing $45.00. This week he worked a total of 9 hr. He received 65¢ an hour. Before this week he had already earned $31.10. How much more money does Jim need to earn to buy the bicycle? $8.05

Explanation This is a three-step problem.

First Step. You have to answer the first **hidden question,** which is: "How much money did Jim earn this week?" He earned $5.85 this week.

$.65
9
$5.85

Second Step. You have to answer the second **hidden question,** which is: "How much has Jim earned in all?" By adding $31.10 and $5.85 you find that Jim has earned $36.95.

$31.10
5.85
$36.95

Third Step. You are now ready to answer the question asked in the problem, which is: "How much more money does Jim need to earn to buy the bicycle?" By subtracting $36.95 from $45.00 you find Jim needs to earn $8.05.

$45.00
36.95
$8.05

Emphasize. In a three-step problem you must answer three questions. Two questions are **hidden questions** which you must answer before you can answer the question asked in the problem.

2. Jack went to the store to buy Christmas presents for five friends. He bought 3 books at $1.25 each and 2 games at $.79 each. How much in all did Jack spend? $5.33

3. Jean's mother made Jean a new dress. She bought 3 yd. of material at $.95 a yard, buttons for $.35, and a pattern for $.45. She could have bought a dress at the store for $8.50. How much did she save by making the dress? $4.85

4. Mary and her mother made 452 cookies last week. They sold all but 8 cookies at $.45 a dozen. How much money did they get for the cookies they sold? $16.65

5. Of the 452 cookies in ex. 4, one half were chocolate cookies and 100 were nut cookies. The rest were sugar cookies. How many sugar cookies were there? 126

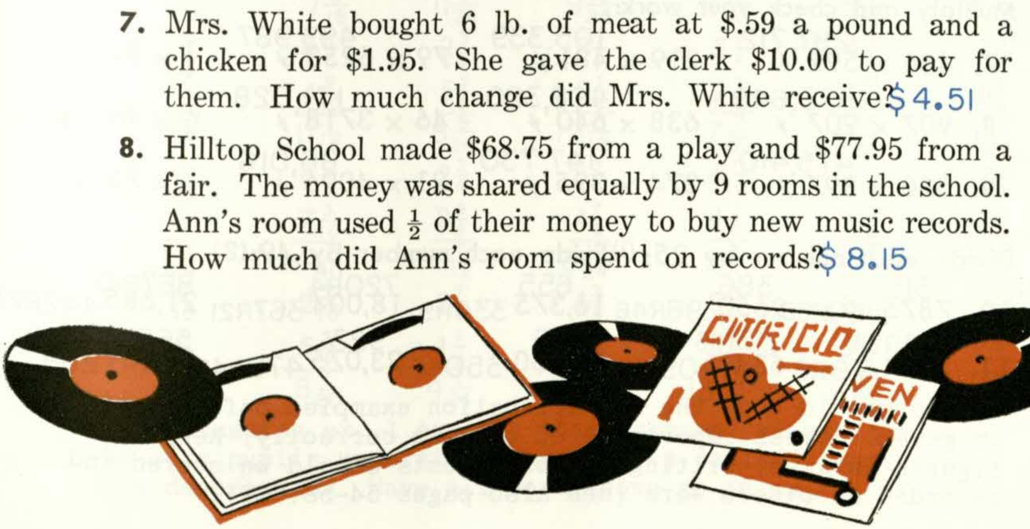
Discuss ex. 1 with pupils. Be sure they understand that they must look for and answer the two hidden questions first before answering problem question. Do ex. 2-5 orally. Have volunteers give hidden questions. Stress estimating answers first.

Have pupils write the hidden questions first and estimate answers to each question. Have volunteers explain their solutions to problems.

Three-Step Problems

There are two hidden questions in each problem on this page. In working each problem first find the hidden questions and answer them. Then answer the question asked in the problem:

1. At a book sale Tom bought one book marked down from \$4.50 to \$2.95 and another book marked down from \$5.00 to \$3.75. On which book was the saving larger and how much larger? The saving was \$.30 larger on the first book.
2. How much change did Jean get from \$3.00 after buying $\frac{7}{8}$ lb. of meat at \$.56 a pound and groceries for \$1.85? \$.66
3. At a sale Mary's mother bought Mary a coat marked \$25.00 and a dress marked \$9.50. The sale price was "$\frac{1}{3}$ off," which means she paid $\frac{1}{3}$ less than the regular price. At $\frac{1}{3}$ off, how much did the coat and dress together cost? \$ 23.00
4. Mrs. Wells bought $\frac{3}{4}$ yd. of ribbon at \$.60 a yard, a pattern for \$.50, and 4 yd. of cloth at \$1.19 a yard. How much did she pay for all these things? \$ 5.71
5. Ben and Andy earned \$8.50 selling seeds. They shared the money equally. With his share Andy bought a bicycle light for \$1.59 and a wire basket for \$1.19. How much did Andy have left? \$ 1.47
6. Ann wants a bicycle that costs \$35.00. She has already saved \$23.10. She can save \$.25 a week from her allowance and \$.45 a week from her earnings. How many weeks will it take Ann to save enough more to buy the bicycle? 17
7. Mrs. White bought 6 lb. of meat at \$.59 a pound and a chicken for \$1.95. She gave the clerk \$10.00 to pay for them. How much change did Mrs. White receive? \$ 4.51
8. Hilltop School made \$68.75 from a play and \$77.95 from a fair. The money was shared equally by 9 rooms in the school. Ann's room used $\frac{1}{2}$ of their money to buy new music records. How much did Ann's room spend on records? \$ 8.15



Present first set of improvement tests in multiplication. Present review of whole numbers and fractions.

Improving by Practice

Multiplication Test 1a. Time: 4 min. after copying.

1.	298	675	409	516	953	387
	45	83	69	27	75	92 ⑥
	13,410	56,025	28,221	13,932	71,475	35,604

Multiplication Test 1b. Time: 4 min. after copying.

2.	853	164	276	708	429	395
	58	47	19	46	62	73 ⑥
	49,474	7708	5244	32,568	26,598	28,835

Multiplication Test 1c. Time: 4 min. after copying.

3.	569	734	925	630	187	842
	84	53	16	97	78	39 ⑥
	47,796	38,902	14,800	61,110	14,586	32,838

Written Review

Add and check your work:

4.	4708	2096	39472	$8\frac{7}{10}$	$8\frac{3}{4}$	$6\frac{3}{16}$
	3629	947	3828	$2\frac{4}{5}$	$5\frac{1}{8}$	$3\frac{5}{16}$
	8337	3043	43,300	$11\frac{1}{2}$	$13\frac{7}{8}$	$9\frac{1}{2}$
5.	1958	6000	43205	$4\frac{3}{4}$	$7\frac{1}{8}$	$5\frac{4}{5}$
	1768	2645	16738	$1\frac{7}{12}$	$4\frac{7}{8}$	$1\frac{1}{2}$
	3726	8645	59,943	$6\frac{1}{3}$	12	$7\frac{3}{10}$

6. Do ex. 4 and 5 again and subtract.

Ex.4: 1079, 1149, 35,644, $5\frac{9}{10}$, $3\frac{5}{8}$, $2\frac{7}{8}$; ex. 5: 190, 3355, 26,467, $3\frac{1}{6}$, $2\frac{1}{4}$, $4\frac{3}{10}$

Multiply and check your work:

7. 486 × 592 287,712 ✓ 219 × 481 105,339 ✓ 79 × 6253 493,987 ✓ $\frac{3}{4}$ × 64 48

8. 907 × 907 822,649 ✓ 638 × 640 408,320 ✓ 46 × 3718 171,028 ✓ $\frac{7}{8}$ × 96 84

9. 530 × 897 475,410 ✓ 374 × 395 147,730 ✓ 21 × 4096 86,016 ✓ $\frac{5}{6}$ × 72 60

Divide each number by 25; (1) divide each number by 49: (2)

(1) 315 386 655 720R4 867R10
(2) **10.** 7875 160R35 9650 196R46 16,375 334R9 18,004 367R21 21,685 442R27

154R24 213R16 686 923 566R11
11. 3874 79R3 5341 109 17,150 350 23,075 470R45 14,161 289

Pupils should copy the multiplication examples before test is given. Stress importance of copying correctly, keeping figures in line, writing legibly. Tests should be scored and recorded as others were (see also pages 54–58, 67).

Teach pupils an efficient method of finding the least common denominator (pages 75–78).

Least Common Denominator

1. **Problem** Find the sum of $\frac{1}{4}$ and $\frac{5}{6}$. $1\frac{1}{12}$

$$\begin{array}{l}\frac{1}{4} = \frac{6}{24}\\ \underline{\frac{5}{6} = \frac{20}{24}}\\ \frac{26}{24} = 1\frac{2}{24} = 1\frac{1}{12}\end{array}$$

Explanation To add $\frac{1}{4}$ and $\frac{5}{6}$ you must change them to fractions having like denominators. When fractions have like denominators they are said to have a **common denominator.** You can find a common denominator for $\frac{1}{4}$ and $\frac{5}{6}$ by multiplying their denominators 4 and 6, which gives 24. How do you change $\frac{1}{4}$ to $\frac{6}{24}$? Explain the other steps in this example.

In the work above a common denominator of 24 is used. Emphasize. You can also use a common denominator of 12 in this example; 12 is called the **least common denominator** because it is the smallest number that contains both 4 and 6 as factors. Explain this work. When you use the least common denominator, you have smaller numbers to work with and the work is shorter.

$$\begin{array}{l}\frac{1}{4} = \frac{3}{12}\\ \underline{\frac{5}{6} = \frac{10}{12}}\\ \frac{13}{12} = 1\frac{1}{12}\end{array}$$

Do ex. 2–3 with pupils. Have them complete ex. 4–6. Let volunteers explain work.

Add. Use the least common denominator:

2.	$\begin{array}{r}\frac{1}{8}\\ \frac{1}{12}\\ \hline \frac{5}{24}\end{array}$	$\begin{array}{r}7\frac{1}{4}\\ 2\frac{3}{10}\\ \hline 9\frac{11}{20}\end{array}$	$\begin{array}{r}3\frac{5}{6}\\ 7\frac{1}{8}\\ \hline 10\frac{23}{24}\end{array}$	$\begin{array}{r}3\frac{1}{6}\\ 4\frac{3}{4}\\ \hline 7\frac{11}{12}\end{array}$	$\begin{array}{r}8\frac{1}{12}\\ 6\frac{7}{8}\\ \hline 14\frac{23}{24}\end{array}$	$\begin{array}{r}3\frac{3}{4}\\ 4\frac{1}{10}\\ \hline 7\frac{17}{20}\end{array}$	$\begin{array}{r}6\frac{1}{4}\\ 3\frac{5}{6}\\ \hline 10\frac{1}{12}\end{array}$
3.	$\begin{array}{r}\frac{3}{4}\\ \frac{9}{10}\\ \hline 1\frac{13}{20}\end{array}$	$\begin{array}{r}3\frac{5}{6}\\ 3\frac{7}{10}\\ \hline 7\frac{8}{15}\end{array}$	$\begin{array}{r}3\frac{1}{6}\\ 8\frac{1}{8}\\ \hline 11\frac{7}{24}\end{array}$	$\begin{array}{r}5\frac{5}{8}\\ 4\frac{1}{6}\\ \hline 9\frac{19}{24}\end{array}$	$\begin{array}{r}1\frac{7}{10}\\ 9\frac{5}{8}\\ \hline 11\frac{13}{40}\end{array}$	$\begin{array}{r}2\frac{3}{4}\\ 2\frac{3}{10}\\ \hline 5\frac{1}{20}\end{array}$	$\begin{array}{r}5\frac{1}{6}\\ 6\frac{1}{4}\\ \hline 11\frac{5}{12}\end{array}$
4.	$\begin{array}{r}\frac{1}{8}\\ \frac{7}{10}\\ \hline \frac{33}{40}\end{array}$	$\begin{array}{r}6\frac{1}{6}\\ 4\frac{9}{10}\\ \hline 11\frac{1}{15}\end{array}$	$\begin{array}{r}2\frac{3}{8}\\ 5\frac{5}{6}\\ \hline 8\frac{5}{24}\end{array}$	$\begin{array}{r}3\frac{1}{4}\\ 9\frac{1}{6}\\ \hline 12\frac{5}{12}\end{array}$	$\begin{array}{r}5\frac{1}{4}\\ 2\frac{1}{10}\\ \hline 7\frac{7}{20}\end{array}$	$\begin{array}{r}4\frac{1}{8}\\ 1\frac{11}{12}\\ \hline 6\frac{1}{24}\end{array}$	$\begin{array}{r}7\frac{3}{8}\\ 8\frac{1}{6}\\ \hline 15\frac{13}{24}\end{array}$
5.	$\begin{array}{r}\frac{7}{12}\\ \frac{7}{8}\\ \hline 1\frac{11}{24}\end{array}$	$\begin{array}{r}6\frac{7}{8}\\ 7\frac{3}{10}\\ \hline 14\frac{7}{40}\end{array}$	$\begin{array}{r}2\frac{3}{4}\\ 3\frac{5}{6}\\ \hline 6\frac{7}{12}\end{array}$	$\begin{array}{r}8\frac{5}{6}\\ 4\frac{7}{8}\\ \hline 13\frac{17}{24}\end{array}$	$\begin{array}{r}4\frac{7}{10}\\ 4\frac{3}{4}\\ \hline 9\frac{9}{20}\end{array}$	$\begin{array}{r}3\frac{1}{10}\\ 1\frac{3}{8}\\ \hline 4\frac{19}{40}\end{array}$	$\begin{array}{r}7\frac{5}{8}\\ 8\frac{5}{6}\\ \hline 16\frac{11}{24}\end{array}$
6.	$\begin{array}{r}\frac{9}{10}\\ \frac{3}{8}\\ \hline 1\frac{11}{40}\end{array}$	$\begin{array}{r}2\frac{3}{10}\\ 5\frac{3}{4}\\ \hline 8\frac{1}{20}\end{array}$	$\begin{array}{r}2\frac{7}{8}\\ 1\frac{1}{6}\\ \hline 4\frac{1}{24}\end{array}$	$\begin{array}{r}4\frac{3}{4}\\ 2\frac{5}{6}\\ \hline 7\frac{7}{12}\end{array}$	$\begin{array}{r}8\frac{5}{12}\\ 5\frac{1}{8}\\ \hline 13\frac{13}{24}\end{array}$	$\begin{array}{r}8\frac{7}{12}\\ 3\frac{3}{8}\\ \hline 11\frac{23}{24}\end{array}$	$\begin{array}{r}2\frac{1}{4}\\ 7\frac{1}{6}\\ \hline 9\frac{5}{12}\end{array}$

In discussing ex. 1 explain that "common" means "the same." Be sure pupils understand why "12" is called "least" common denominator. Have all work shown as in ex. 1.

Least Common Denominator

1. **Problem** To add $\frac{1}{4}$, $\frac{2}{3}$, and $\frac{3}{8}$ you need to find the least common denominator, which is the smallest number that will contain 4, 3, and 8 as factors. Here is an easy way to do it.

Explanation First see if the largest denominator, which is 8, contains as factors both 3 and 4. You find that 8 **does not** contain both of these numbers. Next multiply 8 by 2, which gives 16, and see if 16 contains both 3 and 4; 16 **does not** contain both of them. Then multiply 8 by 3, which gives 24. You find that 24 **does** contain both 3 and 4 as factors; so 24 is the least common denominator. Change $\frac{1}{4}$, $\frac{2}{3}$, and $\frac{3}{8}$ to 24ths, and add the numerators. The sum is $\frac{31}{24}$, which equals $1\frac{7}{24}$.

$$\frac{1}{4} = \frac{6}{24}$$
$$\frac{2}{3} = \frac{16}{24}$$
$$\frac{3}{8} = \frac{9}{24}$$
$$\frac{31}{24} = 1\frac{7}{24}$$

Demonstrate and emphasize.

To find the least common denominator, see if the largest denominator contains as factors the other denominators. If not, multiply it in turn by 2, 3, 4, and so on, until you get a number that contains as a factor each denominator.

Do ex. 2–4 as class activity letting volunteers
Add. Check by going over your work: explain work at board.

2.	$\frac{7}{8}$	$8\frac{3}{4}$	$2\frac{9}{10}$	$4\frac{7}{8}$	$4\frac{5}{6}$	$8\frac{7}{12}$	$2\frac{1}{4}$
	$\frac{1}{6}$	$5\frac{1}{6}$	$1\frac{3}{8}$	$1\frac{1}{3}$	$2\frac{7}{8}$	$3\frac{3}{8}$	$7\frac{1}{6}$
	$1\frac{1}{24}$	$13\frac{11}{12}$	$4\frac{11}{40}$	$6\frac{5}{24}$	$7\frac{17}{24}$	$11\frac{23}{24}$	$9\frac{5}{12}$
3.	$\frac{1}{6}$	$2\frac{1}{2}$	$1\frac{5}{8}$	$1\frac{3}{8}$	$3\frac{7}{8}$	$7\frac{1}{2}$	$5\frac{1}{8}$
	$\frac{1}{8}$	$1\frac{1}{3}$	$3\frac{1}{6}$	$2\frac{5}{6}$	$2\frac{1}{2}$	$1\frac{1}{3}$	$2\frac{3}{4}$
	$\frac{3}{4}$	$1\frac{3}{4}$	$2\frac{1}{12}$	$3\frac{1}{2}$	$4\frac{3}{4}$	$2\frac{1}{10}$	$6\frac{1}{3}$
	$1\frac{1}{24}$	$5\frac{7}{12}$	$6\frac{7}{8}$	$7\frac{17}{24}$	$11\frac{1}{8}$	$10\frac{14}{15}$	$14\frac{5}{24}$
4.	$\frac{5}{6}$	$4\frac{1}{3}$	$3\frac{1}{2}$	$1\frac{3}{8}$	$6\frac{2}{3}$	$4\frac{3}{4}$	$5\frac{2}{3}$
	$\frac{1}{2}$	$2\frac{3}{4}$	$2\frac{2}{3}$	$5\frac{2}{3}$	$2\frac{1}{4}$	$9\frac{4}{5}$	$8\frac{1}{6}$
	$\frac{1}{8}$	$1\frac{1}{6}$	$2\frac{3}{10}$	$3\frac{5}{6}$	$5\frac{5}{8}$	$2\frac{9}{10}$	$7\frac{7}{8}$
	$1\frac{11}{24}$	$8\frac{1}{4}$	$8\frac{7}{15}$	$10\frac{7}{8}$	$14\frac{13}{24}$	$17\frac{9}{20}$	$21\frac{17}{24}$

After discussing ex. 1 with pupils have them find least common denominator in ex. 2–4 in same way. Some pupils may also find them by inspection.

Least Common Denominator

1. **Problem** Subtract $2\frac{5}{6}$ from $6\frac{1}{8}$. $3\frac{7}{24}$

$$\begin{array}{r} 6\frac{1}{8} = 6\frac{3}{24} = 5\frac{27}{24} \\ \underline{2\frac{5}{6} = 2\frac{20}{24} = 2\frac{20}{24}} \\ 3\frac{7}{24} \end{array}$$

Explanation To subtract $2\frac{5}{6}$ from $6\frac{1}{8}$ you must change $\frac{5}{6}$ and $\frac{1}{8}$ to fractions having like denominators. You can find a common denominator by multiplying 6 and 8, which gives 48. But it is shorter to use the least common denominator. You can get it by using the rule on page 76. You find that 8, the larger denominator, does not contain 6 as a factor. Next multiply 8 by 2, which gives 16; you find that 16 does not contain 6. Then multiply 8 by 3, which gives 24; you find that 24 does contain 6 as a factor; so 24 is the least common denominator. Explain how to change $\frac{1}{8}$ and $\frac{5}{6}$ to 24ths. Why do you change $6\frac{3}{24}$ to $5\frac{27}{24}$ before you subtract?

Stress correct written form shown in ex. 1.

Subtract. Check by going over your work:

2.	$\frac{5}{6}$	$4\frac{1}{8}$	$7\frac{1}{6}$	$8\frac{5}{6}$	$6\frac{9}{10}$	$9\frac{3}{10}$	$7\frac{1}{8}$
	$\frac{1}{8}$	$1\frac{3}{16}$	$2\frac{3}{4}$	$3\frac{9}{10}$	$2\frac{1}{4}$	$4\frac{5}{6}$	$2\frac{3}{4}$
	$\frac{17}{24}$	$2\frac{15}{16}$	$4\frac{5}{12}$	$4\frac{14}{15}$	$4\frac{13}{20}$	$4\frac{7}{15}$	$4\frac{3}{8}$
3.	$\frac{5}{6}$	$4\frac{7}{10}$	$8\frac{1}{3}$	$9\frac{5}{8}$	$4\frac{1}{4}$	$7\frac{3}{8}$	$6\frac{1}{4}$
	$\frac{3}{4}$	$1\frac{1}{4}$	$4\frac{3}{4}$	$4\frac{1}{12}$	$2\frac{3}{10}$	$3\frac{7}{10}$	$2\frac{5}{6}$
	$\frac{1}{12}$	$3\frac{9}{20}$	$3\frac{7}{12}$	$5\frac{13}{24}$	$1\frac{19}{20}$	$3\frac{27}{40}$	$3\frac{5}{12}$
4.	$\frac{7}{8}$	$5\frac{9}{16}$	$9\frac{5}{8}$	$6\frac{7}{12}$	$4\frac{3}{10}$	$8\frac{1}{4}$	$5\frac{1}{3}$
	$\frac{3}{4}$	$2\frac{3}{8}$	$1\frac{1}{3}$	$3\frac{1}{2}$	$3\frac{4}{5}$	$5\frac{5}{16}$	$1\frac{5}{6}$
	$\frac{1}{8}$	$3\frac{3}{16}$	$8\frac{7}{24}$	$3\frac{1}{12}$	$\frac{1}{2}$	$2\frac{15}{16}$	$3\frac{1}{2}$
5.	$\frac{7}{8}$	$2\frac{1}{8}$	$5\frac{1}{4}$	$5\frac{3}{8}$	$9\frac{1}{2}$	$7\frac{1}{12}$	$6\frac{2}{3}$
	$\frac{1}{6}$	$1\frac{5}{12}$	$2\frac{3}{8}$	$3\frac{3}{10}$	$6\frac{11}{12}$	$2\frac{5}{12}$	$1\frac{1}{2}$
	$\frac{17}{24}$	$\frac{17}{24}$	$2\frac{7}{8}$	$2\frac{3}{40}$	$2\frac{7}{12}$	$4\frac{2}{3}$	$5\frac{1}{6}$
6.	$\frac{3}{4}$	$6\frac{7}{10}$	$3\frac{1}{2}$	$9\frac{5}{6}$	$3\frac{3}{4}$	$4\frac{5}{8}$	$9\frac{7}{8}$
	$\frac{1}{6}$	$4\frac{1}{2}$	$2\frac{4}{5}$	$3\frac{3}{10}$	$2\frac{5}{16}$	$2\frac{1}{12}$	$2\frac{1}{4}$
	$\frac{7}{12}$	$2\frac{1}{5}$	$\frac{7}{10}$	$6\frac{8}{15}$	$1\frac{7}{16}$	$2\frac{13}{24}$	$7\frac{5}{8}$
7.	$\frac{5}{6}$	$5\frac{3}{10}$	$9\frac{1}{8}$	$7\frac{1}{3}$	$2\frac{3}{4}$	$8\frac{1}{10}$	$7\frac{1}{3}$
	$\frac{1}{4}$	$1\frac{7}{10}$	$3\frac{3}{4}$	$4\frac{7}{12}$	$1\frac{3}{10}$	$6\frac{1}{4}$	$5\frac{3}{4}$
	$\frac{7}{12}$	$3\frac{3}{5}$	$5\frac{3}{8}$	$2\frac{3}{4}$	$1\frac{9}{20}$	$1\frac{17}{20}$	$1\frac{7}{12}$

Explain each step in ex. 1 carefully. Do ex. 2 with pupils. Be sure all understand how to find least common denominator and perform exchange in minuend correctly.

Problems and Practice

1. Last week Mary did baby-sitting on three evenings for these periods of time: $3\frac{1}{2}$ hr., $2\frac{1}{3}$ hr., and $4\frac{3}{4}$ hr. How many hours in all did Mary spend baby-sitting last week? $10\frac{7}{12}$

2. Mr. Hill asked Joe to go to the post office and mail four packages having these weights: $2\frac{1}{4}$ lb., $4\frac{1}{2}$ lb., $1\frac{3}{4}$ lb., $3\frac{5}{8}$ lb. How much did the four packages weigh in all? $12\frac{1}{8}$ lb.

3. The Hiking Club went on three hikes in October. The length of the first hike was $5\frac{3}{4}$ mi., the length of the second was $4\frac{1}{2}$ mi., and the length of the third was $5\frac{1}{8}$ mi. How many miles did the Club hike during October? $15\frac{3}{8}$

4. Four boys weighed themselves and found their weights to be $86\frac{1}{4}$ lb., $79\frac{3}{4}$ lb., $89\frac{1}{2}$ lb., and $80\frac{1}{2}$ lb. What was the average weight of these boys? 84 lb.

Add. Check your work by going over it:

5.	$\frac{5}{8}$	$7\frac{1}{2}$	$2\frac{5}{8}$	$4\frac{2}{3}$	$2\frac{11}{12}$	$5\frac{5}{6}$	$3\frac{1}{2}$
	$\frac{1}{2}$	$2\frac{3}{4}$	$3\frac{1}{2}$	$2\frac{1}{6}$	$2\frac{1}{3}$	$1\frac{5}{12}$	$1\frac{1}{4}$
	$\frac{1}{6}$	$2\frac{7}{8}$	$1\frac{3}{16}$	$1\frac{1}{12}$	$2\frac{1}{4}$	$4\frac{1}{4}$	$4\frac{1}{3}$
	$1\frac{7}{24}$	$13\frac{1}{8}$	$7\frac{5}{16}$	$7\frac{11}{12}$	$7\frac{1}{2}$	$11\frac{1}{2}$	$9\frac{1}{12}$
6.	$\frac{3}{4}$	$1\frac{3}{4}$	$4\frac{7}{12}$	$3\frac{1}{6}$	$5\frac{5}{16}$	$2\frac{1}{6}$	$1\frac{1}{2}$
	$\frac{1}{2}$	$3\frac{5}{6}$	$2\frac{1}{2}$	$1\frac{1}{8}$	$2\frac{1}{4}$	$4\frac{7}{8}$	$6\frac{2}{5}$
	$\frac{2}{3}$	$1\frac{1}{3}$	$5\frac{5}{6}$	$3\frac{1}{12}$	$2\frac{3}{8}$	$9\frac{1}{12}$	$8\frac{1}{6}$
	$1\frac{11}{12}$	$6\frac{11}{12}$	$12\frac{11}{12}$	$7\frac{3}{8}$	$9\frac{15}{16}$	$16\frac{1}{8}$	$16\frac{1}{15}$
7.	$\frac{2}{3}$	$1\frac{1}{3}$	$3\frac{9}{10}$	$1\frac{3}{4}$	$2\frac{5}{12}$	$3\frac{4}{5}$	$2\frac{3}{4}$
	$\frac{1}{4}$	$2\frac{1}{6}$	$4\frac{4}{5}$	$1\frac{1}{2}$	$5\frac{2}{3}$	$1\frac{7}{10}$	$2\frac{1}{2}$
	$\frac{1}{8}$	$1\frac{1}{8}$	$2\frac{1}{2}$	$1\frac{7}{10}$	$2\frac{3}{4}$	$2\frac{1}{2}$	$1\frac{3}{8}$
	$1\frac{1}{24}$	$4\frac{5}{8}$	$11\frac{1}{5}$	$4\frac{19}{20}$	$10\frac{5}{6}$	8	$6\frac{5}{8}$
8.	$\frac{3}{4}$	$2\frac{1}{2}$	$3\frac{1}{3}$	$1\frac{15}{16}$	$2\frac{1}{3}$	$3\frac{5}{6}$	$4\frac{2}{3}$
	$\frac{1}{2}$	$3\frac{2}{3}$	$4\frac{1}{6}$	$5\frac{3}{8}$	$6\frac{3}{4}$	$3\frac{2}{3}$	$1\frac{5}{6}$
	$\frac{2}{3}$	$2\frac{1}{4}$	$1\frac{7}{12}$	$4\frac{3}{4}$	$1\frac{3}{8}$	$5\frac{1}{12}$	$5\frac{3}{4}$
	$\frac{3}{8}$	$2\frac{5}{8}$	$2\frac{1}{2}$	$5\frac{1}{2}$	$2\frac{1}{12}$	$4\frac{1}{2}$	$2\frac{1}{2}$
	$2\frac{7}{24}$	$11\frac{1}{24}$	$11\frac{7}{12}$	$17\frac{9}{16}$	$12\frac{13}{24}$	$17\frac{1}{12}$	$14\frac{3}{4}$

Do ex. 1–4 orally with pupils. Then assign ex. 5–8 as independent work. Check pupils as they work to see if there are any difficulties with least common denominator or exchange.

Present word problems involving mixed operations.

Selling Fruit

1. Mr. Gray grows four kinds of apples. One year he sold 627 baskets of Jonathan apples, 1485 baskets of Red Delicious apples, 1274 baskets of Yellow Delicious apples, and 2986 baskets of Northern Spy apples. How many baskets of apples in all did he sell that year? 6372

2. During one week Mr. Gray sold 536 baskets of peaches at $2.25 per basket. How much did he receive for these peaches? $1206.00

3. When a customer brings back empty baskets in good condition Mr. Gray allows 10¢ for each basket. Ann and her mother drove out to the orchard and bought 2 baskets of peaches priced at $1.95 each. They also returned 4 empty baskets. What was the amount of their bill? $3.50

4. During one week Mr. Gray sold 428 baskets of apples at $1.75 each. How much did he receive for these apples? $749.00

5. Mr. Gray sold 36 baskets of apples to a fruit store for $52.20. Find the cost of these apples per basket. $1.45

6. Tom works for Mr. Gray after school. One week Tom worked $2\frac{1}{2}$ hr. on Tuesday, $2\frac{1}{4}$ hr. on Thursday, and $6\frac{3}{4}$ hr. on Saturday. How many hours did Tom work that week? $11\frac{1}{2}$

7. One week Tom promised to work 10 hours for Mr. Gray. Tom worked $1\frac{3}{4}$ hr. on Wednesday and $2\frac{1}{2}$ hr. on Friday. How long did Tom have to work on Saturday to complete his 10 hr. of work? $5\frac{3}{4}$ hr.

8. Mr. Gray keeps bees in his orchard. He sells their honey in jars that hold 12 oz. of honey. What part of a pound of honey does each jar hold? $\frac{3}{4}$

Have pupils work on problems independently. Check papers carefully to determine kinds of errors made. Return papers to pupils so they may find and correct their mistakes. Help them to determine causes.

Review addition and subtraction of common fractions.

Review of Fractions

1. Peter can swim across the pool in $43\frac{4}{5}$ sec. It takes Don $47\frac{1}{5}$ sec. to swim the same distance. How many seconds faster is Peter's time than Don's time? $3\frac{2}{5}$

2. When Mary gets on the scales holding her baby sister they weigh $87\frac{5}{8}$ lb. Mary alone weighs $73\frac{3}{4}$ lb. How many pounds does the baby weigh? $13\frac{7}{8}$

3. Today Mother needs $\frac{3}{4}$ cup of milk for a cake, $3\frac{1}{2}$ cups for soup, $2\frac{1}{4}$ cups for ice cream, and 6 cups for the children's meals. How many cups of milk does Mother need? $12\frac{1}{2}$

4. A big sled carried 3 children having these weights: $62\frac{1}{2}$ lb., $61\frac{3}{4}$ lb., $59\frac{5}{8}$ lb. How many pounds were there on the sled? $183\frac{7}{8}$

Add. Check your work by going over it:

5.	$2\frac{2}{3}$	$2\frac{7}{8}$	$3\frac{1}{6}$	$4\frac{1}{2}$	$3\frac{7}{10}$	$1\frac{3}{8}$	$1\frac{1}{2}$
	$2\frac{5}{6}$	$3\frac{1}{2}$	$5\frac{1}{4}$	$1\frac{3}{4}$	$5\frac{2}{5}$	$3\frac{7}{12}$	$4\frac{1}{3}$
	$3\frac{1}{2}$	$1\frac{3}{4}$	$3\frac{2}{3}$	$2\frac{9}{16}$	$1\frac{1}{4}$	$4\frac{1}{6}$	$2\frac{11}{12}$
	9	$8\frac{1}{8}$	$12\frac{1}{12}$	$8\frac{13}{16}$	$10\frac{7}{20}$	$9\frac{1}{8}$	$8\frac{3}{4}$

6.	$4\frac{1}{3}$	$2\frac{1}{6}$	$2\frac{3}{4}$	$6\frac{7}{12}$	$5\frac{1}{2}$	$1\frac{9}{10}$	$2\frac{1}{3}$
	$1\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{1}{8}$	$1\frac{3}{4}$	$3\frac{7}{16}$	$5\frac{1}{4}$	$3\frac{5}{8}$
	$2\frac{1}{4}$	$1\frac{3}{8}$	$1\frac{1}{6}$	$3\frac{1}{2}$	$4\frac{1}{8}$	$2\frac{3}{5}$	$2\frac{1}{4}$
	$2\frac{1}{6}$	$3\frac{2}{3}$	$1\frac{2}{3}$	$2\frac{5}{6}$	$1\frac{3}{4}$	$4\frac{1}{2}$	$1\frac{7}{12}$
	$10\frac{1}{4}$	$11\frac{17}{24}$	$10\frac{17}{24}$	$14\frac{2}{3}$	$14\frac{13}{16}$	$14\frac{1}{4}$	$9\frac{19}{24}$

Subtract. Check your work by going over it:

7.	$8\frac{3}{4}$	$5\frac{1}{3}$	$9\frac{1}{6}$	$8\frac{1}{2}$	$7\frac{5}{12}$	$9\frac{1}{2}$	$4\frac{1}{12}$
	$2\frac{1}{8}$	$3\frac{1}{4}$	$4\frac{1}{4}$	$7\frac{7}{16}$	$5\frac{11}{12}$	$1\frac{15}{16}$	$2\frac{3}{8}$
	$6\frac{5}{8}$	$2\frac{1}{12}$	$4\frac{11}{12}$	$1\frac{1}{16}$	$1\frac{1}{2}$	$7\frac{9}{16}$	$1\frac{17}{24}$

8.	$6\frac{1}{2}$	$3\frac{1}{4}$	$9\frac{3}{4}$	$7\frac{3}{5}$	$8\frac{5}{12}$	$5\frac{1}{6}$	$8\frac{9}{10}$
	$2\frac{2}{3}$	$1\frac{7}{8}$	$3\frac{5}{6}$	$4\frac{9}{10}$	$4\frac{1}{6}$	$1\frac{3}{10}$	$6\frac{1}{10}$
	$3\frac{5}{6}$	$1\frac{3}{8}$	$5\frac{11}{12}$	$2\frac{7}{10}$	$4\frac{1}{4}$	$3\frac{13}{15}$	$2\frac{4}{5}$

9.	$9\frac{3}{5}$	$6\frac{1}{8}$	$7\frac{1}{2}$	$4\frac{1}{12}$	$3\frac{3}{4}$	$2\frac{1}{16}$	$6\frac{5}{6}$
	$5\frac{1}{2}$	$3\frac{5}{6}$	$2\frac{5}{6}$	$3\frac{3}{4}$	$2\frac{3}{10}$	$1\frac{13}{16}$	$5\frac{1}{12}$
	$4\frac{1}{10}$	$2\frac{7}{24}$	$4\frac{2}{3}$	$\frac{1}{3}$	$1\frac{9}{20}$	$\frac{1}{4}$	$1\frac{3}{4}$

More Practice. See ⑰ on page 316. Use for individual assistance.

Group pupils who had errors to help them discover causes (exchange, least common denominator, carelessness). Clear up difficulties before assigning remedial work.

Present problems which contain extra facts. Purpose of this activity is to develop pupils' ability to think critically and to train them in discriminate thinking.

Selecting Necessary Facts

Some of the numbers in these problems are not needed to find the answer. In each problem tell which numbers are not needed and then solve the problem:

1. Dick weighs $92\frac{1}{2}$ lb. and is $60\frac{1}{4}$ in. tall. Jim weighs $84\frac{3}{4}$ lb. and is $57\frac{3}{4}$ in. tall. How many inches taller is Dick than Jim? $2\frac{1}{2}$
   ▶ In finding the answer you do not use the weight of either boy, so $92\frac{1}{2}$ and $84\frac{3}{4}$ are unnecessary facts.
2. Mrs. Wood paid \$5.25 for $1\frac{1}{2}$ doz. red roses and \$7.50 for $2\frac{1}{2}$ doz. pink roses. How much did she spend for roses? "$1\frac{1}{2}$" and "$2\frac{1}{2}$" not needed; \$12.75
3. For 3 pairs of new curtains Mrs. Black needs 486 in. of material. How many yards of material must she buy? "3" not needed; $13\frac{1}{2}$
4. The 52 passengers in a big bus rode 135 mi. in 3 hr. What was the average speed of the bus in miles per hour? "52" not needed; 45
5. Ann earns \$2.25 a week. She saves \$.75 a week in the bank. How much will she save in 10 wk.? "\$2.25" not needed; \$7.50
6. Jim delivers 80 magazines every week. He gets \$.20 each for 36 magazines and \$.15 each for 44 magazines. How much does Jim get all together? "80" not needed; \$13.80
7. When Mr. Fox left home he had 16 gal. of gasoline. He bought 35 gal. on the trip and drove 875 mi. in all. When he got back he had 5 gal. left. How many gallons of gasoline did Mr. Fox use on the trip? "875" not needed; 46
8. Betty had \$97.00 when she went to camp. A week at camp cost \$28.50. How much did Betty pay for 3 weeks at camp? "\$97.00" not needed, \$85.50

Have pupils discuss problems and explain why certain facts were not needed.

See G-37 for correlation of examples with aims.

Chapter Review

1. Tell which fractions are proper (P) and which are improper (I):

$\frac{5}{3}$ I $\frac{5}{8}$ P $\frac{12}{4}$ I $\frac{11}{12}$ P $\frac{27}{8}$ I $\frac{10}{15}$ P $\frac{24}{3}$ I $\frac{9}{10}$ P

2. Change to lowest terms: $\frac{12}{18}\,\frac{2}{3}$ $\frac{21}{24}\,\frac{7}{8}$ $\frac{15}{20}\,\frac{3}{4}$ $\frac{45}{54}\,\frac{5}{6}$ $\frac{28}{32}\,\frac{7}{8}$ $\frac{25}{40}\,\frac{5}{8}$

3. Change to mixed numbers: $\frac{10}{3}\,3\frac{1}{3}$ $\frac{14}{6}\,2\frac{1}{3}$ $\frac{43}{8}\,5\frac{3}{8}$ $\frac{32}{5}\,6\frac{2}{5}$ $\frac{30}{8}\,3\frac{3}{4}$

4. Change to twelfths: $\frac{2}{3}\,\frac{8}{12}$ $\frac{1}{2}\,\frac{6}{12}$ $\frac{1}{6}\,\frac{2}{12}$ $\frac{3}{4}\,\frac{9}{12}$ $\frac{1}{3}\,\frac{4}{12}$ $\frac{1}{4}\,\frac{3}{12}$ $\frac{5}{6}\,\frac{10}{12}$

Find the least common denominator (1) and the sum for each example: (2)

(1),(2) **5.** $\frac{1}{6} + \frac{1}{4}$ 12, $\frac{5}{12}$ $\frac{3}{4} + \frac{1}{10}$ 20, $\frac{17}{20}$ $\frac{1}{4} + \frac{2}{3} + \frac{3}{8}$ 24, $1\frac{7}{24}$ $\frac{1}{3} + \frac{3}{4} + \frac{1}{2} + \frac{5}{6}$ 12, $2\frac{5}{12}$

Add. Check by going over your work:

6.	$2\frac{1}{2}$	$6\frac{2}{3}$	$4\frac{3}{4}$	$1\frac{3}{10}$	$3\frac{2}{3}$	$2\frac{1}{4}$	$3\frac{7}{16}$
	$4\frac{5}{8}$	$1\frac{1}{2}$	$2\frac{1}{6}$	$5\frac{4}{5}$	$4\frac{3}{4}$	$3\frac{3}{5}$	$7\frac{1}{4}$
	$1\frac{3}{4}$	$3\frac{5}{6}$	$2\frac{1}{3}$	$2\frac{1}{2}$	$6\frac{5}{12}$	$3\frac{7}{10}$	$1\frac{5}{8}$
	$8\frac{7}{8}$	12	$9\frac{1}{4}$	$9\frac{3}{5}$	$14\frac{5}{6}$	$9\frac{11}{20}$	$12\frac{5}{16}$

7. Mrs. Star needs $2\frac{3}{4}$ yd. of material for Susan's dress, $1\frac{7}{8}$ yd. for her coat, and $\frac{3}{8}$ yd. for a hat. She will buy the same material for all. How many yards must she buy? 5

8. Last month Bill had \$1.47 on hand and received \$1.50, \$.75, and \$2.25. He spent \$.28, \$.79, \$1.25, \$.19, and \$1.07. What was his balance at the end of last month? \$2.39

9. Sally bought 2 pairs of stockings at \$.79 a pair and 3 handkerchiefs at \$.49 each. How much did she spend all together? \$3.05

10. How much did George spend when he bought 3 books at \$1.39 each and 2 games at \$.98 each? \$6.13

Tell what missing number goes in the numerator:

11. $4 = 3\frac{?}{6}$ 6 $5\frac{1}{8} = 4\frac{?}{8}$ 9 $4\frac{3}{16} = 3\frac{?}{16}$ 19 $5\frac{5}{8} = 5\frac{?}{16}$ 10 $= 4\frac{?}{16}$ 26

12. $9 = 8\frac{?}{2}$ 2 $7\frac{3}{5} = 6\frac{?}{5}$ 8 $6\frac{7}{10} = 5\frac{?}{10}$ 17 $8\frac{5}{6} = 8\frac{?}{12}$ 10 $= 7\frac{?}{12}$ 22

13. $7 = 6\frac{?}{4}$ 4 $3\frac{1}{4} = 2\frac{?}{4}$ 5 $2\frac{5}{12} = 1\frac{?}{12}$ 17 $3\frac{2}{5} = 3\frac{?}{10}$ 4 $= 2\frac{?}{10}$ 14

This review may be considered as readiness test for next unit of work. If many pupils seem weak in particular area, reteaching of topic may be necessary. Be sure pupils understand causes of errors before assigning remedial work.

A Problem Test

1. Paul had a board 10 ft. long. He cut off a piece $1\frac{3}{4}$ ft. long. How many feet of board did he have left? $8\frac{1}{4}$

2. Train tickets from Beaver to Jackson are \$.55 each. A 20-trip ticket costs \$9.40. If Mr. Green takes this ride often, how much can he save by buying a 20-trip ticket? \$1.60

3. Every school day Betty spends \$.30 for lunch and \$.09 each way for bus fare. How much does she spend in a week of 5 school days if she rides to school and back once each day? \$2.40

4. Jack's uncle climbed to the top of a mountain 8350 ft. high. How many feet higher than 1 mi. is the mountain? 3070
   ▶ 5280 ft. = 1 mi.

5. Find the cost of 75 ft. of ribbon at \$.15 a yard. \$3.75

6. On four days last week Bill worked for Mr. Chase. He wrote these hours in his notebook: $2\frac{3}{4}$ hr., 3 hr., $2\frac{1}{2}$ hr., and $2\frac{1}{4}$ hr. How many hours in all did Bill work? $10\frac{1}{2}$

7. The 36 pupils in Mary's room at school shared the cost of buying 28 yd. of material for clown suits at \$.63 a yard. Find the amount each pupil paid. \$.49

8. Today Jim spent \$2.00. He bought 3 neckties at \$.55 each and 5-cent pencils with the remainder. How many pencils did Jim buy? 7

9. Find the money taken in from 473 lunches at \$.35 each. \$165.55

10. Tom bought 1 bu. of apples at \$3.75. He sold them all at \$.15 a quart. How much more did he get for the apples than he paid for them? \$1.05

How many problems did you get right? Look below to find out what your score means.

Remind pupils to graph their scores (see page 41).

SCORE	0–5 You need help	6–7 Fair	8–9 Good	10 Excellent

Instruct pupils to read problems carefully to determine what facts are given and what they must find out. Try to determine if problem situations, processes, poor judgment, and so on, cause errors. Plan remedial programs accordingly.

Present diagnostic test of fraction skills.

How Much Have You Learned?

If you miss more than one example in a row, turn to the Practice Pages for that row.

Change each fraction to lowest terms:

						Practice Pages
1.	$\frac{12}{24}\ \frac{1}{2}$	$\frac{16}{20}\ \frac{4}{5}$	$\frac{12}{16}\ \frac{3}{4}$	$\frac{15}{24}\ \frac{5}{8}$	$\frac{75}{100}\ \frac{3}{4}$	60

Change these fractions to mixed numbers:

2.	$\frac{11}{4}\ 2\frac{3}{4}$	$\frac{15}{6}\ 2\frac{1}{2}$	$\frac{36}{10}\ 3\frac{3}{5}$	$\frac{17}{5}\ 3\frac{2}{5}$	$\frac{30}{12}\ 2\frac{1}{2}$	61

Write the number that goes in each numerator:

3.	$6 = 5\frac{3}{3}$	$4\frac{1}{4} = 3\frac{5}{4}$	$7\frac{1}{2} = 7\frac{8}{16} = 6\frac{24}{16}$	68
4.	$9 = 8\frac{5}{5}$	$5\frac{3}{8} = 4\frac{11}{8}$	$4\frac{5}{6} = 4\frac{10}{12} = 3\frac{22}{12}$	68

Add. Check by going over your work:

5.	$4\frac{1}{4}$	$1\frac{3}{8}$	$4\frac{1}{3}$	$5\frac{7}{12}$	$7\frac{7}{10}$	
	$\frac{3}{4}$	$2\frac{3}{8}$	$3\frac{1}{3}$	$1\frac{11}{12}$	$2\frac{3}{10}$	62
	5	$3\frac{3}{4}$	$7\frac{2}{3}$	$7\frac{1}{2}$	10	
6.	$1\frac{5}{6}$	$\frac{3}{4}$	$7\frac{2}{3}$	$1\frac{5}{16}$	$3\frac{1}{3}$	
	$1\frac{2}{3}$	$2\frac{1}{3}$	$3\frac{1}{2}$	$6\frac{3}{4}$	$3\frac{11}{12}$	64
	$3\frac{1}{2}$	$3\frac{1}{12}$	$11\frac{1}{6}$	$8\frac{1}{16}$	$7\frac{1}{4}$	
7.	$2\frac{1}{6}$	$1\frac{1}{2}$	$2\frac{1}{2}$	$3\frac{1}{2}$	$2\frac{3}{4}$	
	$1\frac{3}{8}$	$4\frac{5}{6}$	$\frac{5}{8}$	$3\frac{5}{12}$	$2\frac{1}{10}$	76
	$2\frac{1}{2}$	$3\frac{3}{4}$	$1\frac{1}{3}$	$1\frac{7}{8}$	$2\frac{1}{2}$	
	$6\frac{1}{24}$	$10\frac{1}{12}$	$4\frac{11}{24}$	$8\frac{19}{24}$	$7\frac{7}{20}$	

Subtract. Check by going over your work:

8.	$6\frac{7}{8}$	$9\frac{1}{2}$	$6\frac{3}{4}$	$5\frac{11}{12}$	$8\frac{13}{16}$	
	$1\frac{1}{8}$	$2\frac{1}{5}$	$3\frac{1}{8}$	$4\frac{5}{12}$	$4\frac{3}{8}$	66
	$5\frac{3}{4}$	$7\frac{3}{10}$	$3\frac{5}{8}$	$1\frac{1}{2}$	$4\frac{7}{16}$	
9.	6	$8\frac{1}{8}$	$7\frac{1}{6}$	$4\frac{1}{2}$	$5\frac{1}{4}$	
	$3\frac{1}{3}$	$5\frac{5}{8}$	$1\frac{2}{3}$	$2\frac{9}{10}$	$1\frac{7}{12}$	69, 70
	$2\frac{2}{3}$	$2\frac{1}{2}$	$5\frac{1}{2}$	$1\frac{3}{5}$	$3\frac{2}{3}$	

Pupils should have good understanding and competency in this work before doing further work in fractions. Reteach where necessary, before assigning practice pages.

See G-39 for specific aims of Chapter 3.

Chapter 3

Forest Fires

1. Each year in this country forest fires cause great damage to timber, destroy homes, and damage other kinds of property. Forest rangers police our forests to prevent forest fires. It cost \$29,000,000 in 1950 to protect our forests from fire. The size of the protected forest area was 573,000,000 acres. Was this about 4¢, 5¢, or 6¢ an acre? 5¢

2. In 1959, \$54,000,000 was spent to protect our forests from fire. That year the size of the protected area was 761,000,000 acres. Was this about 6¢, 7¢, or 8¢ an acre? 7¢

3. It cost \$57,000,000 to protect our forests from fire in 1960. How much more was spent for forest protection in 1960 than in 1950? \$28,000,000 About how much did the cost of forest protection increase, on the average, each year in the ten-year period from 1950 to 1960? \$2,800,000

Before doing problems discuss with pupils what your state is doing for forest-fire prevention. Urge them to find out more about the program and report findings to class.

Note that problems on these pages may be correlated with social studies, in particular, ex. 7.

Forest Fires

1. In 1959 there were 104,622 forest fires in all. Of these fires, 86,737 were in the protected forest area. How many forest fires were in the unprotected area? 17,885

2. In 1950 there were 208,400 forest fires in all. About how many times as many were there this year as in 1959? 2 times as many

3. The forest fires in 1959 burned over a total of 4,155,000 acres of forest land. In the protected forest area, 2,578,000 acres were burned over. How many acres were burned over in the unprotected forest area? 1,577,000

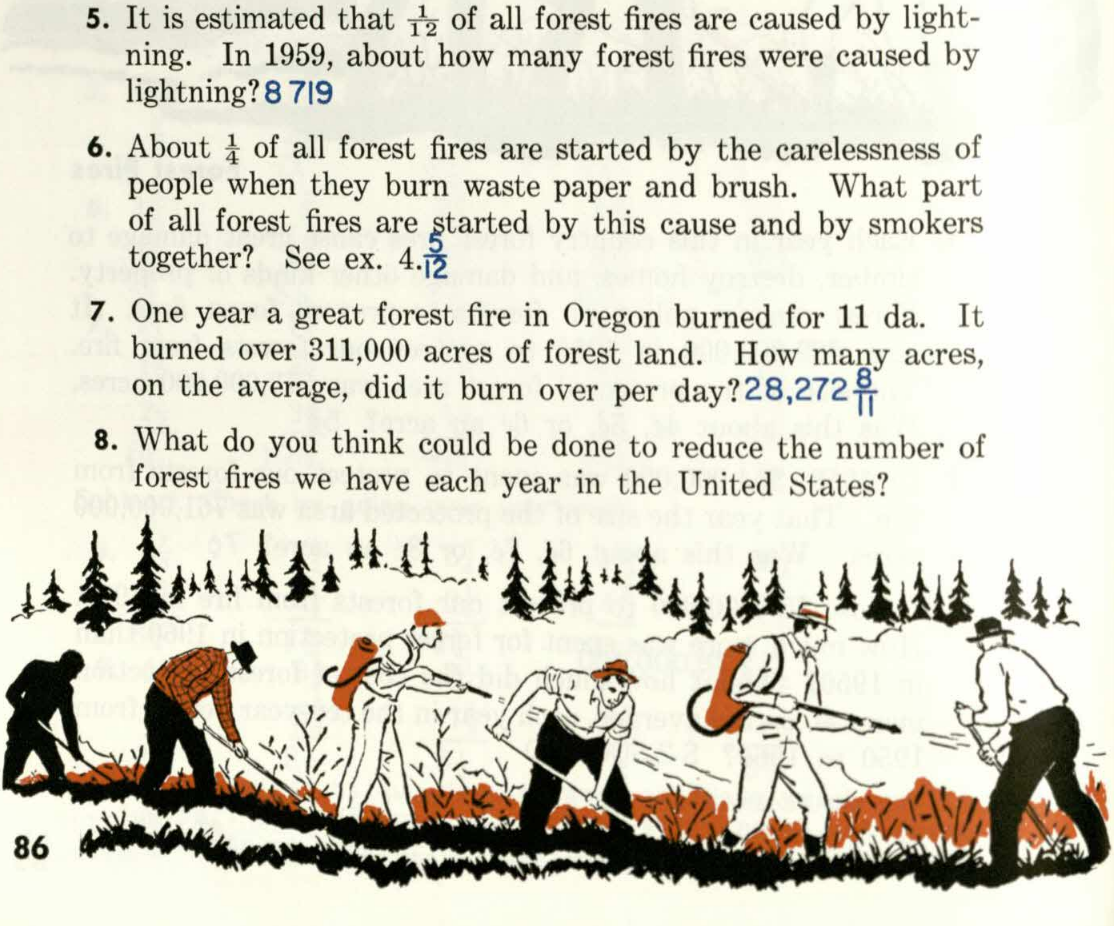
4. Forest fires are caused by smokers, by persons who are careless when burning debris, by lightning, by sparks from railroad engines, and by campers. It is estimated that $\frac{1}{6}$ of all forest fires are caused by careless smokers. Of the 104,622 forest fires in 1959, about how many were caused by smokers? 17,437

5. It is estimated that $\frac{1}{12}$ of all forest fires are caused by lightning. In 1959, about how many forest fires were caused by lightning? 8 719

6. About $\frac{1}{4}$ of all forest fires are started by the carelessness of people when they burn waste paper and brush. What part of all forest fires are started by this cause and by smokers together? See ex. 4. $\frac{5}{12}$

7. One year a great forest fire in Oregon burned for 11 da. It burned over 311,000 acres of forest land. How many acres, on the average, did it burn over per day? $28{,}272\frac{8}{11}$

8. What do you think could be done to reduce the number of forest fires we have each year in the United States?



Review how to find fractional part of whole number.

Finding Fractional Parts

First review how to find fractional part using unit fraction.

1. Mary asked the clerk in a store for $\frac{3}{4}$ yd. of linen at 84¢ a yard. How much did the linen cost? 63¢

▶ You must find $\frac{3}{4}$ of 84¢. $\frac{1}{4}$ of 84 is 21. So $\frac{3}{4}$ of 84 is 3×21, or 63. The cost of the linen was 63¢.

Emphasize meaning of × sign as given in ex. 2.

2. Another way to write $\frac{3}{4}$ of 84 is $\frac{3}{4} \times 84$. The sign × means "of" when the multiplier is a fraction. When you find $\frac{3}{4}$ of 84, you are multiplying 84 by $\frac{3}{4}$. This is called finding a fractional part of 84. When the numbers are not large, you can do the work mentally.

Have pupils prove some answers in ex. 3-12 with diagrams and semiconcrete representations (crosses, dots).

Find the answers. Do the work mentally:

3. $\frac{1}{4}$ of 12 3 $\frac{3}{4}$ of 12 9 $\frac{1}{3} \times 6$ 2 $\frac{3}{5} \times 20$ 12 $\frac{7}{8} \times 40$ 35

4. $\frac{1}{5}$ of 15 3 $\frac{3}{5}$ of 15 9 $\frac{1}{4} \times 8$ 2 $\frac{2}{3} \times 33$ 22 $\frac{3}{4} \times 28$ 21

5. $\frac{1}{3}$ of 12 4 $\frac{2}{3}$ of 12 8 $\frac{1}{5} \times 5$ 1 $\frac{5}{6} \times 54$ 45 $\frac{2}{3} \times 21$ 14

6. $\frac{1}{6}$ of 18 3 $\frac{5}{6}$ of 18 15 $\frac{2}{3} \times 9$ 6 $\frac{3}{4} \times 44$ 33 $\frac{1}{2} \times 46$ 23

7. $\frac{1}{4}$ of 24 6 $\frac{3}{4}$ of 24 18 $\frac{5}{6} \times 6$ 5 $\frac{7}{8} \times 16$ 14 $\frac{5}{6} \times 36$ 30

8. $\frac{1}{3}$ of 27 9 $\frac{2}{3}$ of 27 18 $\frac{1}{2} \times 4$ 2 $\frac{1}{4} \times 48$ 12 $\frac{3}{10} \times 60$ 18

9. $\frac{1}{2}$ of 14 7 $\frac{1}{2}$ of 10 5 $\frac{3}{4} \times 8$ 6 $\frac{3}{8} \times 24$ 9 $\frac{1}{12} \times 48$ 4

10. $\frac{1}{4}$ of 32 8 $\frac{3}{4}$ of 32 24 $\frac{2}{3} \times 6$ 4 $\frac{4}{5} \times 50$ 40 $\frac{3}{16} \times 32$ 6

11. $\frac{7}{8}$ of 48 42 $\frac{5}{6}$ of 48 40 $\frac{2}{5} \times 5$ 2 $\frac{1}{6} \times 42$ 7 $\frac{9}{10} \times 20$ 18

12. $\frac{5}{6}$ of 36 30 $\frac{4}{5}$ of 35 28 $\frac{1}{2} \times 8$ 4 $\frac{5}{8} \times 64$ 40 $\frac{5}{12} \times 60$ 25

Use objects and diagrams in demonstrating ex. 1-2. Stress that denominator tells you to divide group into 4 equal parts and numerator tells you that you have 3 of these equal parts (therefore can add or multiply to find how many in all).

Review multiplication of whole number by mixed number.

Multiplying by a Mixed Number

1. Problem Jack went to the store to buy a chicken for his mother. He bought one weighing $3\frac{3}{4}$ lb. which cost \$.52 a pound. How much did Jack pay for the chicken? \$ 1.95

Explanation First find $\frac{3}{4}$ of 52, which is 39. Then multiply 52 by 3, which is 156. Be sure to place the 6 of 156 under the 3 by which you are multiplying, as shown at the right. Then add 39 and 156 and put in the decimal point. Jack paid \$1.95.

$$\begin{array}{r} \$.52 \\ \underline{3\frac{3}{4}} \\ 39 \\ \underline{1\ 56} \\ \$1.95 \end{array}$$

2. Betsy's mother bought $2\frac{5}{8}$ yd. of velvet for a new dress for Betsy. The velvet cost \$2.48 a yard. How much did the velvet for the dress cost? \$ 6.51

3. Mrs. Green bought a roast at the meat market. It weighed $5\frac{3}{4}$ lb. and cost \$.56 a pound. How much did the roast cost? \$ 3.22

4. Judy and her mother are making new curtains for Judy's room. They need $8\frac{1}{2}$ yd. of material. If the curtain material costs \$.96 a yard, how much will all the material cost? \$ 8.16

5. Last week Tom worked $7\frac{3}{4}$ hr. for Mr. Grant. He earned \$.60 an hour. How much did Tom earn last week? \$ 4.65

Emphasize.

To multiply a whole number by a mixed number, multiply first by the fraction and then by the whole number and add the products.

Have pupils explain work at board in ex. 6–8.

Multiply. Check your work by going over it:

6. $2\frac{3}{8} \times 32$ 76 $3\frac{1}{2} \times 82$ 287 $4\frac{3}{4} \times 124$ 589 $14\frac{1}{2} \times 64$ 928

7. $3\frac{2}{3} \times 48$ 176 $6\frac{7}{8} \times 40$ 275 $3\frac{2}{5} \times 135$ 459 $16\frac{3}{4} \times 72$ 1206

8. $5\frac{1}{2} \times 98$ 539 $4\frac{5}{8} \times 64$ 296 $2\frac{1}{2} \times 194$ 485 $19\frac{2}{3} \times 39$ 767

More Practice. See ⑱ on page 316.

Pupils should have no difficulty with this work if material on page 87 was clearly understood. Emphasize proper placement of partial products in particular, why "6" in ex. 1 was placed in ones column.

Teach how to find fractional parts of numbers, using different procedure, where mental arithmetic may be difficult.

Finding Fractional Parts

1. **Problem** How much must you pay for $\frac{5}{8}$ lb. of cheese if it costs 56¢ a pound? 35¢

Explanation You must find $\frac{5}{8} \times 56$. You can divide 56 by 8 and multiply the result by 5, which gives 35. That is, you can **divide first and then multiply.**

You can also get the right answer if you multiply 56 by 5 and divide the result by 8, as shown at the right. That is, you can **multiply first and then divide.**

$$\frac{5}{8} \times 56 = \frac{5 \times 56}{8} = \frac{280}{8} = 35$$

2. **Problem** How much would you have to pay for the cheese if it costs 57¢ a pound instead of 56¢ a pound? $35\frac{5}{8}$¢, or 36¢

Explanation You must find $\frac{5}{8} \times 57$. Since 8 does not divide 57 exactly, it is easier to **multiply first and then divide,** as shown above. You multiply 57 by 5, which gives 285, and then divide 285 by 8, which gives $35\frac{5}{8}$. The cheese costs $35\frac{5}{8}$¢, which is called 36¢. In stores, a fraction of a cent is counted as another cent.

$$\frac{5}{8} \times 57 = \frac{5 \times 57}{8} = \frac{285}{8} = 35\frac{5}{8}$$

Find the answers: Have pupils multiply first, then divide.

3. $\frac{3}{4} \times 5$ $3\frac{3}{4}$ $\frac{2}{5} \times 11$ $4\frac{2}{5}$ $\frac{7}{8} \times 11$ $9\frac{5}{8}$ $\frac{1}{2} \times 27$ $13\frac{1}{2}$ $\frac{3}{10} \times 11$ $3\frac{3}{10}$

4. $\frac{2}{3} \times 7$ $4\frac{2}{3}$ $\frac{3}{4} \times 17$ $12\frac{3}{4}$ $\frac{4}{5} \times 13$ $10\frac{2}{5}$ $\frac{5}{8} \times 15$ $9\frac{3}{8}$ $\frac{5}{16} \times 17$ $5\frac{5}{16}$

5. $\frac{3}{8} \times 3$ $1\frac{1}{8}$ $\frac{1}{6} \times 19$ $3\frac{1}{6}$ $\frac{3}{8} \times 25$ $9\frac{3}{8}$ $\frac{3}{5} \times 12$ $7\frac{1}{5}$ $\frac{7}{12} \times 13$ $7\frac{7}{12}$

6. $\frac{4}{5} \times 9$ $7\frac{1}{5}$ $\frac{1}{8} \times 21$ $2\frac{5}{8}$ $\frac{2}{5} \times 16$ $6\frac{2}{5}$ $\frac{1}{6} \times 35$ $5\frac{5}{6}$ $\frac{7}{16} \times 11$ $4\frac{13}{16}$

7. $\frac{1}{2} \times 7$ $3\frac{1}{2}$ $\frac{2}{3} \times 16$ $10\frac{2}{3}$ $\frac{3}{4} \times 13$ $9\frac{3}{4}$ $\frac{4}{5} \times 11$ $8\frac{4}{5}$ $\frac{9}{10} \times 11$ $9\frac{9}{10}$

8. $\frac{3}{5} \times 6$ $3\frac{3}{5}$ $\frac{1}{5} \times 18$ $3\frac{3}{5}$ $\frac{1}{2} \times 19$ $9\frac{1}{2}$ $\frac{1}{8} \times 37$ $4\frac{5}{8}$ $\frac{1}{12} \times 17$ $1\frac{5}{12}$

9. $\frac{5}{6} \times 5$ $4\frac{1}{6}$ $\frac{1}{3} \times 10$ $3\frac{1}{3}$ $\frac{1}{4} \times 21$ $5\frac{1}{4}$ $\frac{7}{8} \times 17$ $14\frac{7}{8}$ $\frac{9}{16} \times 13$ $7\frac{5}{16}$

10. $\frac{5}{8} \times 7$ $4\frac{3}{8}$ $\frac{5}{6} \times 17$ $14\frac{1}{6}$ $\frac{2}{3} \times 20$ $13\frac{1}{3}$ $\frac{1}{5} \times 22$ $4\frac{2}{5}$ $\frac{7}{10} \times 13$ $9\frac{1}{10}$

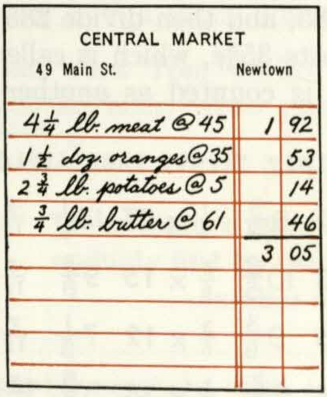
11. $\frac{7}{8} \times 5$ $4\frac{3}{8}$ $\frac{1}{4} \times 15$ $3\frac{3}{4}$ $\frac{3}{8} \times 19$ $7\frac{1}{8}$ $\frac{3}{5} \times 16$ $9\frac{3}{5}$ $\frac{5}{12} \times 11$ $4\frac{7}{12}$

Point out and emphasize difference between method used on page 87 and that explained on this page. Let pupils try to do ex. 2 by first method, to point out difficulty. Stress meaning of × sign after a fraction.

Present practical application of fractions in everyday life, and teach pupils how to make out sales slips.

The Club Picnic

1. **Problem** Ann and Peggy did the shopping for the picnic their club had last summer in Peggy's yard. At the Central Market they received a sales slip, which is shown at the left.



CENTRAL MARKET
49 Main St. Newtown

$4\frac{1}{4}$ lb. meat @ 45	1 92
$1\frac{1}{2}$ doz. oranges @ 35	53
$2\frac{3}{4}$ lb. potatoes @ 5	14
$\frac{3}{4}$ lb. butter @ 61	46
	3 05

Explanation On the slip "$4\frac{1}{4}$ lb. meat @ 45" means that the meat cost 45¢ a pound. "$1\frac{1}{2}$ doz. oranges @ 35" means that the oranges cost 35¢ a dozen. The sign @ means "at." The slip shows that $4\frac{1}{4}$ lb. meat at 45¢ cost \$1.92. To get \$1.92 the work is done as follows:

First multiply \$.45 by $\frac{1}{4}$ to find the cost of $\frac{1}{4}$ lb. of meat. Then multiply \$.45 by 4 to find the cost of 4 lb. of meat. Add the products and put in the decimal point. The answer is \$1.91$\frac{1}{4}$, which you call \$1.92. When you buy things in stores, Stress→ **any fraction** of a cent is usually counted as another cent. The meat cost \$1.92. Check by going over the work.

$$\begin{array}{r} \$.45 \\ 4\frac{1}{4} \\ \hline 11\frac{1}{4} \\ 1\ 80 \\ \hline \$1.91\frac{1}{4} \\ \\ \$1.92 \end{array}$$

Have pupils check practice used by local storekeepers in dealing with fraction of a cent. Be sure they understand meaning of @ sign. Give pupils practice in making out sales slips in connection with real sales (school fair, class store).

2. The sales slip on page 90 also shows the cost of oranges, potatoes, and butter. Show how each of these amounts was found and check the total paid.

3. At the Smith Bakery the girls bought $2\frac{1}{2}$ doz. rolls at 35¢ a dozen and $1\frac{1}{2}$ doz. cupcakes at 65¢ a dozen. Make a sales slip like the one on page 90, fill out the amounts for the rolls and cakes, and find the total bill.

4. Mary is club treasurer. She said that the club had $8.15 cash on hand before the picnic. How much was left after she paid for the food Ann and Peggy bought at the Central Market and the Smith Bakery? $ 3.24

Remind pupils to multiply first, then divide in finding fractional parts.

Multiply. Count any fraction of a cent as another cent: Stress.

5. $3\frac{1}{4} \times 13$ $42\frac{1}{4}$ $2\frac{1}{2} \times \$.75$ $1.88 $1\frac{3}{4} \times \$1.90$ $3.33 $3\frac{1}{2} \times \$1.25$ $4.38

6. $1\frac{3}{4} \times 37$ $64\frac{3}{4}$ $3\frac{1}{8} \times \$.17$ $.54 $7\frac{1}{2} \times \$1.83$ $13.73 $1\frac{1}{4} \times \$2.10$ $2.63

7. $4\frac{2}{3} \times 19$ $88\frac{2}{3}$ $6\frac{1}{2} \times \$.75$ $4.88 $3\frac{1}{8} \times \$1.25$ $3.91 $5\frac{3}{4} \times \$1.19$ $6.85

8. $1\frac{3}{4} \times 15$ $26\frac{1}{4}$ $1\frac{1}{4} \times \$.33$ $.42 $2\frac{7}{8} \times \$2.50$ $7.19 $3\frac{3}{8} \times \$1.00$ $3.38

9. $7\frac{1}{3} \times 29$ $212\frac{2}{3}$ $2\frac{5}{8} \times \$.39$ $1.03 $4\frac{1}{2} \times \$1.75$ $7.88 $2\frac{1}{8} \times \$1.35$ $2.87

More Practice. See ⑲ on page 316.

Do problems with pupils, in particular, be sure ex. 3 is done correctly. Have pupils do ex. 5–9 independently. Have pupils who seem to have difficulty explain their computations aloud. Assign "More Practice" after difficulties are cleared up.

Teach or reteach multiplication of fractions and mixed numbers by whole numbers (pages 92–93).

Making Cocoa

1. **Problem** Jean uses $\frac{3}{4}$ cup of milk for each cup of cocoa that she makes. How many cups of milk will she need if she wishes to make 5 cups of cocoa? $3\frac{3}{4}$

Explanation To find the number of cups of milk that Jean will need, you must multiply 3 **fourths** by 5.

$$5 \times \frac{3}{4} = \frac{5 \times 3}{4} = \frac{15}{4} = 3\tfrac{3}{4}$$

5×3 **fourths** = 15 fourths, or $\frac{15}{4}$. This can be changed to $3\frac{3}{4}$. So Jean will need $3\frac{3}{4}$ cups of milk.

2. Jean belongs to a club that has 17 members. If she makes one cup of cocoa for each member of the club, how many cups of milk will she need? $12\frac{3}{4}$

3. Ellen uses $\frac{2}{3}$ cup of milk for each cup of cocoa that she makes. How many cups of milk will she need for 8 cups of cocoa? for 5 cups? $3\frac{1}{3}$

$5\frac{1}{3}$

4. Study these examples: Have pupils explain examples.

$6 \times \frac{3}{4} = \frac{18}{4} = 4\frac{1}{2}$ $9 \times \frac{2}{3} = \frac{18}{3} = 6$ $14 \times \frac{5}{8} = \frac{70}{8} = 8\frac{3}{4}$

Always change any fraction in an answer to lowest terms. Stress.

Emphasize.

To multiply a fraction by a whole number, multiply the numerator by the whole number and divide the product by the denominator.

Multiply. Do the work mentally if you can:

5. $5 \times \frac{1}{2}$ $2\frac{1}{2}$ $9 \times \frac{3}{4}$ $6\frac{3}{4}$ $7 \times \frac{1}{6}$ $1\frac{1}{6}$ $7 \times \frac{2}{3}$ $4\frac{2}{3}$ $2 \times \frac{3}{4}$ $1\frac{1}{2}$ $4 \times \frac{1}{6}$ $\frac{2}{3}$

6. $5 \times \frac{2}{3}$ $3\frac{1}{3}$ $2 \times \frac{5}{6}$ $1\frac{2}{3}$ $4 \times \frac{3}{5}$ $2\frac{2}{5}$ $9 \times \frac{5}{6}$ $7\frac{1}{2}$ $6 \times \frac{5}{8}$ $3\frac{3}{4}$ $7 \times \frac{2}{5}$ $2\frac{4}{5}$

7. $8 \times \frac{1}{5}$ $1\frac{3}{5}$ $5 \times \frac{1}{4}$ $1\frac{1}{4}$ $3 \times \frac{3}{4}$ $2\frac{1}{4}$ $2 \times \frac{4}{5}$ $1\frac{3}{5}$ $9 \times \frac{3}{5}$ $5\frac{2}{5}$ $7 \times \frac{3}{4}$ $5\frac{1}{4}$

8. $9 \times \frac{1}{6}$ $1\frac{1}{2}$ $8 \times \frac{1}{3}$ $2\frac{2}{3}$ $6 \times \frac{1}{4}$ $1\frac{1}{2}$ $5 \times \frac{1}{8}$ $\frac{5}{8}$ $6 \times \frac{3}{4}$ $4\frac{1}{2}$ $3 \times \frac{3}{8}$ $1\frac{1}{8}$

9. $5 \times \frac{1}{6}$ $\frac{5}{6}$ $7 \times \frac{3}{8}$ $2\frac{5}{8}$ $7 \times \frac{1}{2}$ $3\frac{1}{2}$ $6 \times \frac{7}{8}$ $5\frac{1}{4}$ $5 \times \frac{5}{6}$ $4\frac{1}{6}$ $6 \times \frac{2}{3}$ 4

Before discussing ex. 1 explanation ask pupils for suggestions in solving problem (addition). Then discuss ex. 1 explanation, stressing 5 × 3 "fourths" before showing algorism, $5 \times \frac{3}{4}$. Use diagrams to develop clearer understanding.

Finding Distances

1. **Problem** Ben's father drives $14\frac{5}{8}$ mi. to his work and back each day. He works 5 da. a week. How many miles in all does Ben's father drive to work and back in a week? $73\frac{1}{8}$

Explanation You must multiply $14\frac{5}{8}$ by 5. First multiply $\frac{5}{8}$ by 5, which gives $3\frac{1}{8}$. Then multiply 14 by 5. Place the products as shown at the right. Then add these products, which gives $73\frac{1}{8}$. Ben's father drives $73\frac{1}{8}$ mi. to work and back in a week.

$$\begin{array}{r} 14\frac{5}{8} \\ 5 \\ \hline 3\frac{1}{8} \\ 70 \\ \hline 73\frac{1}{8} \end{array}$$

2. Study these examples. Explain how the work is done:
Be sure these examples are understood before proceeding.

$$\begin{array}{r} 9\frac{3}{4} \\ 8 \\ \hline 6 \\ 72 \\ \hline 78 \end{array} \qquad \begin{array}{r} 14\frac{1}{2} \\ 2 \\ \hline 1 \\ 28 \\ \hline 29 \end{array} \qquad \begin{array}{r} 2\frac{1}{8} \\ 6 \\ \hline 12\frac{3}{4} \end{array} \qquad \begin{array}{r} 24\frac{3}{4} \\ 6 \\ \hline 4\frac{1}{2} \\ 144 \\ \hline 148\frac{1}{2} \end{array}$$

3. Ben walks $1\frac{3}{4}$ mi. a day going to school and back. How many miles does Ben walk in 5 da. going to school and back? $8\frac{3}{4}$

4. The swimming pool is $1\frac{3}{8}$ mi. from Ben's house. During one week last summer Ben rode his bicycle to the pool and back 4 times. How many times did Ben ride $1\frac{3}{8}$ mi.? 8 Find the distance he rode that week going to the pool and back. 11 mi.

5. Uncle Jim lives $38\frac{1}{2}$ mi. from Ben's house. How far is the round trip from Ben's house to Uncle Jim's and back? 77 mi.

Have pupils explain work in ex. 6–9 at blackboard.

Multiply. Check your work by going over it:

6. $8 \times 3\frac{3}{4}$ 30 $\quad 7 \times 5\frac{2}{3}$ $39\frac{2}{3}$ $\quad 3 \times 8\frac{5}{8}$ $25\frac{7}{8}$ $\quad 3 \times 16\frac{3}{4}$ $50\frac{1}{4}$ $\quad 24 \times 17\frac{1}{2}$ 420

7. $4 \times 6\frac{1}{2}$ 26 $\quad 8 \times 2\frac{1}{3}$ $18\frac{2}{3}$ $\quad 7 \times 5\frac{1}{2}$ $38\frac{1}{2}$ $\quad 5 \times 23\frac{4}{5}$ 119 $\quad 16 \times 75\frac{2}{3}$ $1210\frac{2}{3}$

8. $5 \times 2\frac{3}{8}$ $11\frac{7}{8}$ $\quad 3 \times 6\frac{3}{4}$ $20\frac{1}{4}$ $\quad 5 \times 3\frac{7}{8}$ $19\frac{3}{8}$ $\quad 6 \times 38\frac{5}{6}$ 233 $\quad 28 \times 19\frac{1}{4}$ 539

9. $7 \times 2\frac{3}{5}$ $18\frac{1}{5}$ $\quad 4 \times 3\frac{1}{6}$ $12\frac{2}{3}$ $\quad 8 \times 4\frac{3}{8}$ 35 $\quad 3 \times 24\frac{3}{4}$ $74\frac{1}{4}$ $\quad 15 \times 24\frac{1}{6}$ $362\frac{1}{2}$

More Practice. See ⑳ on page 317. Use to reinforce skill.

Explain multiplication of $\frac{5}{8}$ by 5 through addition first. Then use diagrams to demonstrate. Have pupils show multiplication of fraction by whole number as in ex. 1 on page 92. Assign ex. 6–9 as independent work; note errors for remedial work.

Review and extend measures of length to include rods. Although the rod is seldom used today in America as measure, it is introduced as appreciation of way people used to measure. Have pupils investigate its historical background.

Measures of Length

1. Learn this table of measures of length. It shows how the different measures of length are related:

Make class chart.

12 inches (in.) = 1 foot (ft.)
3 feet (ft.) = 1 yard (yd.)
$16\frac{1}{2}$ feet or $5\frac{1}{2}$ yards = 1 rod (rd.)
5280 feet or 320 rods = 1 mile (mi.)

2. The **rod** is one of the measures of length; it is sometimes used to measure fields or other farm land. A rod is $16\frac{1}{2}$ ft. long. Measure off $16\frac{1}{2}$ ft. on the floor to get an idea of the length of the rod. How many rods make 1 mi?

3. How many feet are there in 2 rd.? 33 in 6 rd.? 99 in 9 rd.? $148\frac{1}{2}$

4. How many yards are there in 4 rd.? 22 in 8 rd.? 44 in 5 rd.? $27\frac{1}{2}$

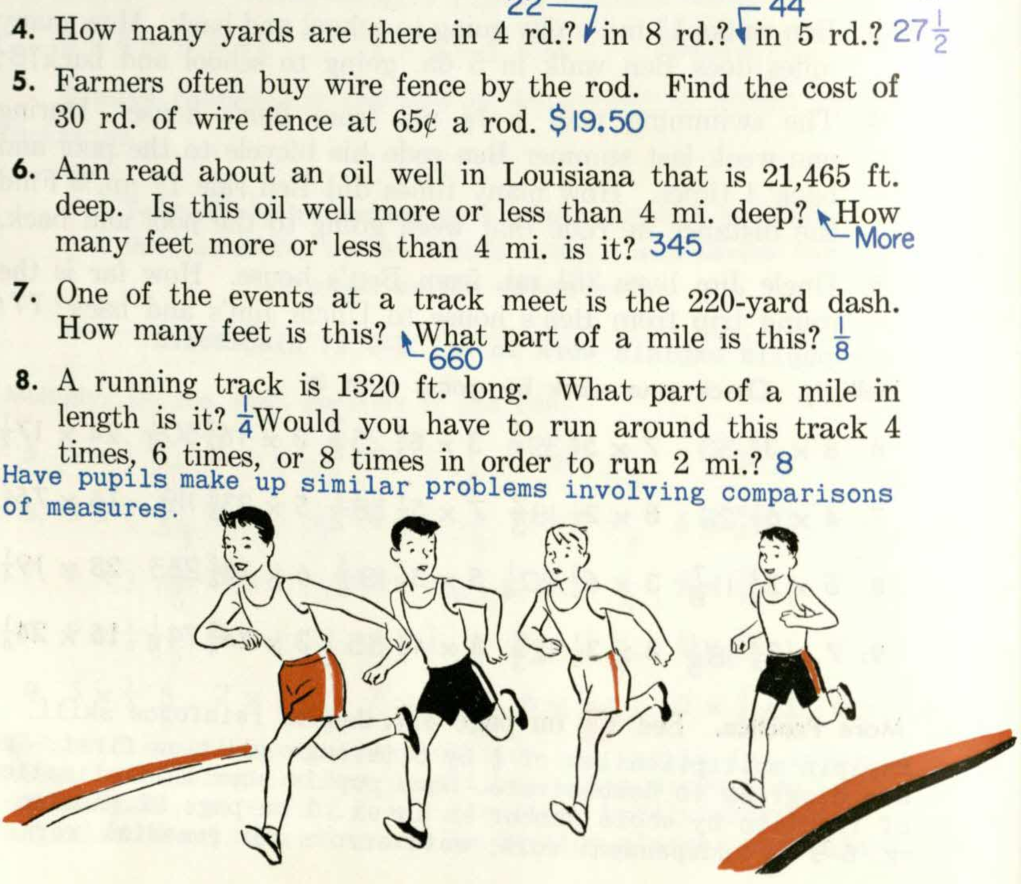
5. Farmers often buy wire fence by the rod. Find the cost of 30 rd. of wire fence at 65¢ a rod. $19.50

6. Ann read about an oil well in Louisiana that is 21,465 ft. deep. Is this oil well more or less than 4 mi. deep? More How many feet more or less than 4 mi. is it? 345

7. One of the events at a track meet is the 220-yard dash. How many feet is this? 660 What part of a mile is this? $\frac{1}{8}$

8. A running track is 1320 ft. long. What part of a mile in length is it? $\frac{1}{4}$ Would you have to run around this track 4 times, 6 times, or 8 times in order to run 2 mi.? 8

Have pupils make up similar problems involving comparisons of measures.



Present first set of improvement tests
in division. Present review of measures.

Improving by Practice

Division Test 1a.

Time: $3\frac{1}{2}$ min. after copying.

1. $\begin{array}{r} 970 \text{ R } 3 \\ 9\overline{)8733} \end{array}$ $\begin{array}{r} 608 \text{ R } 7 \\ 8\overline{)4871} \end{array}$ $\begin{array}{r} 635 \text{ R } 5 \\ 7\overline{)4450} \end{array}$

2. $\begin{array}{r} 819 \\ 7\overline{)5733} \end{array}$ $\begin{array}{r} 279 \\ 9\overline{)2511} \end{array}$ $\begin{array}{r} 473 \\ 6\overline{)2838} \end{array}$ ⑥

Division Test 1b.

Time: $3\frac{1}{2}$ min. after copying.

3. $\begin{array}{r} 462 \text{ R } 5 \\ 6\overline{)2777} \end{array}$ $\begin{array}{r} 256 \\ 8\overline{)2048} \end{array}$ $\begin{array}{r} 418 \\ 9\overline{)3762} \end{array}$

4. $\begin{array}{r} 295 \text{ R } 7 \\ 9\overline{)2662} \end{array}$ $\begin{array}{r} 538 \\ 7\overline{)3766} \end{array}$ $\begin{array}{r} 407 \text{ R } 1 \\ 8\overline{)3257} \end{array}$ ⑥

Division Test 1c.

Time: $3\frac{1}{2}$ min. after copying.

5. $\begin{array}{r} 715 \text{ R } 1 \\ 7\overline{)5006} \end{array}$ $\begin{array}{r} 564 \\ 6\overline{)3384} \end{array}$ $\begin{array}{r} 609 \\ 8\overline{)4872} \end{array}$

6. $\begin{array}{r} 963 \\ 9\overline{)8667} \end{array}$ $\begin{array}{r} 540 \text{ R } 6 \\ 8\overline{)4326} \end{array}$ $\begin{array}{r} 871 \text{ R } 2 \\ 6\overline{)5228} \end{array}$ ⑥

Measures

Tell what number is missing in each space:

7. 1 mi. = 5280 ft. 3 qt. = 6 pt. 15 ft. = 5 yd.
8. 1 bu. = 4 pk. 6 in. = $\frac{1}{2}$ ft. 32 qt. = 1 bu.
9. 1 ft. = 12 in. 8 oz. = $\frac{1}{2}$ lb. 18 in. = $\frac{1}{2}$ yd.
10. $\frac{1}{2}$ yd. = 18 in. 5 ft. = 60 in. 27 in. = $\frac{3}{4}$ yd.
11. $\frac{1}{4}$ lb. = 4 oz. 2 wk. = 14 da. 32 qt. = 8 gal.
12. $\frac{2}{3}$ yd. = 2 ft. 8 qt. = 1 pk. 12 gal. = 48 qt.
13. $\frac{3}{4}$ yd. = 27 in. 9 mo. = $\frac{3}{4}$ yr. 30 min. = $\frac{1}{2}$ hr.
14. $\frac{1}{2}$ mi. = 2640 ft. 3 yr. = 36 mo. 45 min. = $\frac{3}{4}$ hr.
15. $\frac{3}{4}$ hr. = 45 min. 8 pt. = 1 gal. 15 sec. = $\frac{1}{4}$ min.

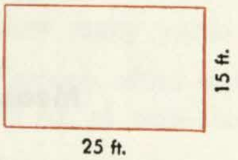
To the Teacher. In ex. 1–6, pupils should write R before remainders.

Check each pupil's paper carefully to determine kinds of errors. Group pupils who had mistakes to help them analyze causes. Reteach or review as needed. Have all pupils determine own scores and record them.

First discuss pupils' experiences in finding perimeter (fencing for garden, picture frames)

Finding Perimeters

1. **Problem** Dick has a vegetable garden 25 ft. long and 15 ft. wide. He wants to put wire netting around it to keep out the rabbits. How many feet of netting does he need? 80



Explanation To find the number of feet around the garden, you must find the sum of the four sides. 25 ft. + 15 ft. + 25 ft. + 15 ft. = 80 ft. So Dick needs at least 80 ft. of wire netting.

Dick's garden has the shape of a rectangle. The length and width, 25 ft. and 15 ft., are called the **dimensions** of the rectangle. The distance around it is called the **perimeter.** The perimeter of the garden is 80 ft.

Stress meanings.

2. You can find the perimeter of Dick's garden another way, like this: 2 × 25 ft. = 50 ft.; 2 × 15 ft. = 30 ft.; 50 ft. + 30 ft. = 80 ft. Which way do you like better, this way or the way used in ex. 1? Give a reason for your answer.

Have pupils explain "why" they can find perimeter this way.

3. You can use a **formula** to tell how to find the perimeter of a rectangle. If l stands for its length, w for its width, and P for its perimeter, then $P = (2 \times l) + (2 \times w)$. Since multiplication signs are usually omitted in formulas, this formula can also be written $P = 2l + 2w$. $2l$ means $2 \times l$. $2w$ means $2 \times w$.

In discussing perimeter encourage use of terms "distance all around," "all around the outside," and so on. Be sure pupils understand meaning of dimensions, perimeter, and explanation of short way of writing feet and inches (ex. 11).

4. What is the perimeter of a rectangle 4 ft. long and $2\frac{1}{2}$ ft. wide? 13 ft. of a rectangle 31 in. long and 17 in. wide? 96 in.

5. Peggy knit a large number of wool squares which she sewed together to make a blanket shaped like a rectangle. The blanket is 56 in. wide and 76 in. long. She needed ribbon to sew around the edge of the blanket to bind it. How many inches is it around the blanket? 264

6. Peggy's mother told her to buy 6 in. of ribbon more than the perimeter of the blanket so that she could make neat corners and join the ends nicely. How many yards of ribbon did Peggy buy? $7\frac{1}{2}$

7. In the city in which Andy lives, each block is a rectangle 200 ft. wide and 240 ft. long. How many feet does Andy run if he runs around the block once? 880 if he runs around 6 times? 5280 Does 6 times around make a mile? Yes

8. Ann has a garden 18 ft. long and 10 ft. 6 in. wide. What is the perimeter of Ann's garden in feet? 57

▶ Change 10 ft. 6 in. to $10\frac{1}{2}$ ft. because the length is given in feet. Both dimensions must be in the same unit of measure. Emphasize.

9. You can also work ex. 8 by changing both dimensions to inches. Then the perimeter is in inches. What would you do to get the perimeter in feet? Divide by 12 Which is the better way to work the problem, this way or the one in ex. 8? Why? The one in ex. 8; there is less work.

10. What is the perimeter of a rectangle 11 in. by 1 ft. 7 in.? Is it better to give the answer in feet or in inches? 60 in., or 5 ft.

11. A short way to write 4 ft. is 4′; a short way to write 31 in. is 31″. Find the perimeter of a rectangle measuring 7″ by 11″; 36 in. of a rectangle measuring 3′ by $7\frac{1}{2}'$. 21 ft. Another way to write 7″ by 11″ is 7″ × 11″. The sign × means "by."

Find the perimeters of rectangles with these dimensions:

12. 9 yd. by 14 yd. 46 yd. 15″ by 24″ 78″ $7\frac{1}{2}' \times 9$ 33′

13. 6 in. by 11 in. 34 in. 21″ by 36″ 114″ $4\frac{1}{2}' \times 7\frac{1}{2}$ 24′

14. 4 ft. by 6 ft. 3 in. $20\frac{1}{2}$ ft. 10″ by 30″ 80″ $6\frac{3}{4}' \times 9\frac{1}{4}$ 32′

Have pupils draw diagrams for these examples and label all dimensions. Do ex. 4-11 first and have volunteers put work on board. Then assign ex. 12-14 and observe pupils as they work. Group pupils for further review as needed.

Present review of basic skills and vocabulary (page 99).

Keeping in Practice

Multiply and check the work:

1. 46 × 93 4278 328 × 574 188,272 506 × 832 420,992 49 × \$12.40 \$607.60

2. 91 × 99 9009 517 × 791 408,947 368 × 981 361,008 73 × \$50.28 \$3670.44

3. 80 × 89 7120 605 × 605 366,025 940 × 975 916,500 28 × \$26.39 \$738.92

4. 75 × 75 5625 476 × 643 306,068 189 × 836 158,004 31 × \$63.25 \$1960.75

5. Find the difference between \$600.00 and \$431.45. \$168.55

6. Find the weight of 75 boxes each weighing 250 lb. 18,750 lb.

7. Find the sum of \$14.85, \$7.59, \$.96, \$5.79, and \$.75. \$29.94

8. Divide \$173.25 equally among 25 persons. \$6.93

Copy in columns, add, and check:

9. 369; 348; 476; 605; 324 2122 766; 497; 645; 574; 457 2939

10. 483; 965; 397; 788; 123 2756 934; 282; 338; 437; 809 2800

11. 715; 189; 629; 512; 225 2270 260; 453; 196; 384; 719 2012

12. 316; 585; 602; 151; 548 2202 578; 379; 205; 636; 202 2000

13. Subtract 32,968 from each number below: (1)

(1) 57,274 24,306 81,566 48,598 70,000 37,032 38,838 5870 52,955 19,987

(2) 51,857 76,149 64,583 33,421 47,538

14. Subtract 5417 from each number in the line above. (2)

Find the answers. Watch the signs: Emphasize.

15. $6\frac{3}{8} + 1\frac{1}{8} + 2\frac{5}{8}$ $10\frac{1}{8}$ $5\frac{1}{2} - 3\frac{7}{8}$ $1\frac{5}{8}$ $1\frac{2}{3} \times 5$ $8\frac{1}{3}$ $\frac{7}{8} \times 56$ 49

16. $2\frac{1}{2} + 5\frac{5}{6} + 3\frac{2}{3}$ 12 $3\frac{7}{10} + 5\frac{4}{5}$ $9\frac{1}{2}$ $5\frac{1}{4} \times 8$ 42 $9 \times 4\frac{1}{2}$ $40\frac{1}{2}$

17. $5\frac{1}{6} + 2\frac{3}{4} + 4\frac{1}{2}$ $12\frac{5}{12}$ $4\frac{1}{12} - 2\frac{1}{2}$ $1\frac{7}{12}$ $2\frac{1}{2} \times 7$ $17\frac{1}{2}$ $\frac{3}{4} \times 19$ $14\frac{1}{4}$

18. $8\frac{3}{4} + 8\frac{3}{4} + 5\frac{1}{2}$ 23 $7\frac{1}{4} - 1\frac{11}{12}$ $5\frac{1}{3}$ $4\frac{1}{3} \times 9$ 39 $7 \times 6\frac{3}{8}$ $44\frac{5}{8}$

19. $7\frac{1}{4} + 4\frac{1}{2} + 5\frac{3}{16}$ $16\frac{15}{16}$ $2\frac{1}{10} + 3\frac{7}{10}$ $5\frac{4}{5}$ $1\frac{3}{4} \times 6$ $10\frac{1}{2}$ $\frac{5}{6} \times 14$ $11\frac{2}{3}$

20. $2\frac{3}{5} + 3\frac{3}{4} + 1\frac{7}{10}$ $8\frac{1}{20}$ $6\frac{3}{16} - 2\frac{7}{16}$ $3\frac{3}{4}$ $3\frac{2}{3} \times 7$ $25\frac{2}{3}$ $8 \times 4\frac{3}{5}$ $36\frac{4}{5}$

Pupils who have mastery of these skills need complete only first line of each type of example. Let them then work at arithmetic corner. Group others and have them do computations aloud to help discover causes of difficulties.

The Language of Arithmetic

In the sentences below give the correct word for each space. Do not write in the spaces:

1. In an addition example, the numbers to be added are called addends; the answer is called the sum.

2. In a subtraction example, the number from which you subtract is called the minuend; the number to be subtracted is called the subtrahend; the answer is called the remainder or the difference.

3. Numbers containing 7, 8, or 9 figures stand for millions; numbers containing 10, 11, or 12 figures stand for billions.

4. In multiplication the number that is multiplied is the multiplicand; the number by which you multiply is the multiplier; the answer is the product.

5. In division the number that is divided is the dividend; the number by which you divide is the divisor; the answer is the quotient. If there is a number left over, it is the remainder

6. In the fraction $\frac{5}{6}$, 5 is the numerator of the fraction and 6 is the denominator of the fraction. 5 and 6 are called the terms of the fraction.

7. The fraction $\frac{5}{6}$ is called a proper fraction and the fraction $\frac{11}{8}$ is called an improper fraction.

8. The number $5\frac{3}{4}$ is called a mixed number.

9. The smallest number that contains as factors all the denominators of several fractions is called the least common denominator.

10. When you have changed $\frac{4}{8}$ to $\frac{1}{2}$, you have changed $\frac{4}{8}$ to lowest terms.

11. When you find the distance around a rectangle, you are finding its perimeter

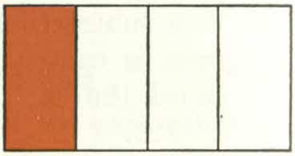
12. When you say that a rectangle has a length of 35 ft. and a width of 23 ft., you are giving the dimensions of the rectangle.

Some pupils may need further review of vocabulary. Have them make study cards for terms they are unsure of. Print terms on front of card and illustrate meaning on back (as a label, in an example). Let others prepare quiz program on terms.

Multiplying a Fraction by a Fraction

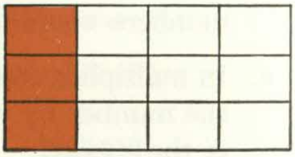
1. Problem Judy's mother baked a cake in the shape of a rectangle. She said that Judy could have $\frac{1}{4}$ of the cake to share with two of her friends. What part of the whole cake did each of the three girls receive? $\frac{1}{12}$

A



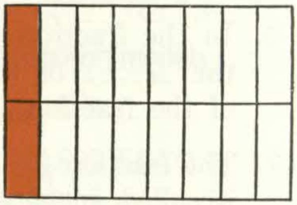
Explanation You must find $\frac{1}{3}$ of $\frac{1}{4}$. The rectangle at A stands for the whole cake. It is divided into 4 equal parts. Judy's part, which is $\frac{1}{4}$ of the cake, is red.

B



The rectangle at B shows each **fourth** of the cake divided into three equal parts. Into how many equal parts is the whole cake divided now? 12 You see that each girl received $\frac{1}{12}$ of the cake. $\frac{1}{3}$ of $\frac{1}{4} = \frac{1}{12}$.

2. Another way to write $\frac{1}{3}$ of $\frac{1}{4}$ is $\frac{1}{3} \times \frac{1}{4}$. The sign × means "of" when the multiplier is a fraction, although it is read "times." So $\frac{1}{3} \times \frac{1}{4} = \frac{1}{12}$.



3. Find $\frac{1}{2} \times \frac{1}{8}$. First draw a rectangle, divide it into 8 equal parts, and make one of these parts red. What part of the rectangle is red? $\frac{1}{8}$ Now draw a line so that each **eighth** of the rectangle is divided into two equal parts. Explain how the drawing shows that $\frac{1}{2}$ of $\frac{1}{8}$ equals $\frac{1}{16}$, or $\frac{1}{2} \times \frac{1}{8}$ equals $\frac{1}{16}$.

4. Make drawings to find:

$\frac{1}{2} \times \frac{1}{4}$ $\frac{1}{8}$ $\frac{1}{2} \times \frac{1}{3}$ $\frac{1}{6}$ $\frac{1}{3} \times \frac{1}{8}$ $\frac{1}{24}$ $\frac{1}{3} \times \frac{1}{5}$ $\frac{1}{15}$ $\frac{1}{4} \times \frac{1}{4}$ $\frac{1}{16}$

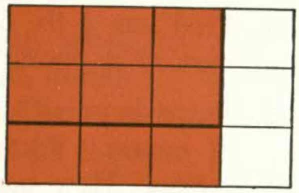
▶ To show $\frac{1}{2} \times \frac{1}{4}$, draw a rectangle 1″ by 2″. Divide its length into 4 equal parts and draw lines as in A above. Then divide its width into 2 equal parts and draw a line. How many equal parts are there now? 8 How much is $\frac{1}{2}$ of $\frac{1}{4}$? $\frac{1}{8}$

5. Ellen bought $\frac{1}{2}$ yd. of red velvet. She gave Susan $\frac{1}{2}$ of the velvet. What part of a yard did Susan receive? $\frac{1}{4}$

`Follow development as given on these pages. Emphasize explanation of × sign in ex. 2. Have pupils use materials (paper rectangles) and perform actions in ex. 1-3. Then have them make drawings for other examples. Do all work with class.`

6. **Problem** Mr. Gray bought a piece of land which is $\frac{3}{4}$ of an acre. He is going to use $\frac{2}{3}$ of it for a peach orchard. What part of an acre will his peach orchard be? $\frac{6}{12}$, or $\frac{1}{2}$

Explanation You must find $\frac{2}{3}$ of $\frac{3}{4}$, or $\frac{2}{3} \times \frac{3}{4}$. Draw a rectangle to stand for 1 acre, divide it into 4 equal parts, and make 3 of these equal parts red. What does the red part of the rectangle stand for? Now draw 2 horizontal lines so that the red part of the rectangle will be divided into 3 equal parts. Into how many equal parts is the whole rectangle divided? How many of these parts make up $\frac{2}{3}$ of the red part of the rectangle? You see that $\frac{2}{3} \times \frac{3}{4} = \frac{6}{12}$. So Mr. Gray's peach orchard will be $\frac{6}{12}$, or $\frac{1}{2}$, of an acre.



7. Make drawings to find the answers:

$\frac{1}{2} \times \frac{3}{4}$ $\frac{3}{8}$ $\frac{1}{3} \times \frac{5}{6}$ $\frac{5}{18}$ $\frac{1}{2} \times \frac{7}{8}$ $\frac{7}{16}$ $\frac{1}{2} \times \frac{5}{8}$ $\frac{5}{16}$ $\frac{2}{3} \times \frac{7}{8}$ $\frac{14}{24}$, or $\frac{7}{12}$

8. Instead of finding the product of two fractions by making a drawing, you can multiply the numerators and then multiply the denominators, as shown below:

$$\frac{1}{2} \times \frac{1}{8} = \frac{1 \times 1}{2 \times 8} = \frac{1}{16} \qquad \frac{2}{3} \times \frac{5}{6} = \frac{2 \times 5}{3 \times 6} = \frac{10}{18} = \frac{5}{9}$$

Find the answers in ex. 7 in this way.

Multiply. Change the answers to lowest terms when possible: Stress.

9. $\frac{1}{2} \times \frac{4}{5}$ $\frac{2}{5}$ $\frac{2}{5} \times \frac{3}{4}$ $\frac{3}{10}$ $\frac{1}{3} \times \frac{3}{8}$ $\frac{1}{8}$ $\frac{3}{4} \times \frac{1}{6}$ $\frac{1}{8}$ $\frac{4}{5} \times \frac{3}{8}$ $\frac{3}{10}$

10. $\frac{1}{8} \times \frac{3}{4}$ $\frac{3}{32}$ $\frac{5}{8} \times \frac{1}{3}$ $\frac{5}{24}$ $\frac{3}{8} \times \frac{1}{2}$ $\frac{3}{16}$ $\frac{3}{5} \times \frac{5}{8}$ $\frac{3}{8}$ $\frac{2}{3} \times \frac{1}{4}$ $\frac{1}{6}$

Emphasize.

To multiply a fraction by a fraction, first multiply the numerators; then multiply the denominators.

See if pupils can see way to multiply fractions, as given in ex. 8, before discussing it. Again emphasize meaning of × sign. Ask pupils "if" and then "why" product is smaller than original fraction (you are finding a part of a part).

Present applications of multiplication of fractions in problems showing uses of fractions. Give further practice in multiplication of fractions.

Using Fractions

1. Frank had $\frac{1}{2}$ yd. of canvas. He gave Dick $\frac{1}{2}$ of it. What part of a yard did he give Dick? $\frac{1}{4}$

2. Fred has $\frac{3}{4}$ lb. of candy. If he gives $\frac{1}{3}$ of it to Jack, what part of a pound will he give Jack? $\frac{3}{12}$, or $\frac{1}{4}$

3. Patty is going to make ice cream. The recipe calls for $\frac{3}{4}$ qt. of cream. Patty wants to make $\frac{2}{3}$ of the amount of the recipe. How much cream should she use? $\frac{6}{12}$ qt., or $\frac{1}{2}$ qt. (1 pt.)

4. Jane is making cookies. The recipe calls for $\frac{2}{3}$ cup of chopped nuts. If Jane makes $\frac{1}{2}$ of the amount of the recipe, what part of a cup of chopped nuts should she use? $\frac{2}{6}$, or $\frac{1}{3}$

5. Bob can walk to Green Lake in $\frac{2}{3}$ hr. He says that he can ride his bicycle to the lake in $\frac{1}{4}$ of that time. How long does it take Bob to ride to Green Lake? $\frac{2}{12}$ hr., or $\frac{1}{6}$ hr.

6. Peter picked $\frac{1}{2}$ bu. of apples for Mr. Bell. If Mr. Bell gave Peter $\frac{1}{2}$ of the apples, what part of a bushel did he get? $\frac{1}{4}$

7. Mr. Hill has a garden that is $\frac{1}{8}$ of an acre. He plants corn in $\frac{1}{3}$ of it. What part of an acre is planted in corn? $\frac{1}{24}$

Have pupils prove some answers with drawings as check of understandings.

Multiply. Change the answers to lowest terms when possible: Stress.

8. $\frac{1}{4} \times \frac{3}{8}$ $\frac{3}{32}$ $\frac{2}{3} \times \frac{4}{5}$ $\frac{8}{15}$ $\frac{1}{6} \times \frac{2}{5}$ $\frac{1}{15}$ $\frac{2}{3} \times \frac{3}{5}$ $\frac{2}{5}$ $\frac{1}{2}$ of $\frac{7}{8}$ $\frac{7}{16}$

9. $\frac{1}{2} \times \frac{3}{4}$ $\frac{3}{8}$ $\frac{3}{4} \times \frac{1}{6}$ $\frac{1}{8}$ $\frac{2}{3} \times \frac{3}{8}$ $\frac{1}{4}$ $\frac{3}{4} \times \frac{2}{3}$ $\frac{1}{2}$ $\frac{1}{3}$ of $\frac{5}{6}$ $\frac{5}{18}$

10. $\frac{1}{3} \times \frac{1}{4}$ $\frac{1}{12}$ $\frac{1}{5} \times \frac{3}{4}$ $\frac{3}{20}$ $\frac{1}{2} \times \frac{1}{2}$ $\frac{1}{4}$ $\frac{5}{6} \times \frac{1}{2}$ $\frac{5}{12}$ $\frac{1}{5}$ of $\frac{5}{6}$ $\frac{1}{6}$

11. $\frac{1}{6} \times \frac{1}{2}$ $\frac{1}{12}$ $\frac{1}{4} \times \frac{2}{5}$ $\frac{1}{10}$ $\frac{2}{3} \times \frac{1}{6}$ $\frac{1}{9}$ $\frac{1}{2} \times \frac{2}{3}$ $\frac{1}{3}$ $\frac{1}{2}$ of $\frac{3}{8}$ $\frac{3}{16}$

12. $\frac{1}{5} \times \frac{5}{8}$ $\frac{1}{8}$ $\frac{2}{3} \times \frac{2}{3}$ $\frac{4}{9}$ $\frac{1}{4} \times \frac{3}{4}$ $\frac{3}{16}$ $\frac{1}{5} \times \frac{1}{4}$ $\frac{1}{20}$ $\frac{1}{8}$ of $\frac{1}{2}$ $\frac{1}{16}$

13. $\frac{1}{4} \times \frac{1}{4}$ $\frac{1}{16}$ $\frac{4}{5} \times \frac{1}{2}$ $\frac{2}{5}$ $\frac{2}{3} \times \frac{1}{4}$ $\frac{1}{6}$ $\frac{4}{5} \times \frac{5}{6}$ $\frac{2}{3}$ $\frac{1}{2}$ of $\frac{5}{8}$ $\frac{5}{16}$

14. $\frac{1}{3} \times \frac{3}{4}$ $\frac{1}{4}$ $\frac{2}{3} \times \frac{5}{6}$ $\frac{5}{9}$ $\frac{1}{4} \times \frac{1}{5}$ $\frac{1}{20}$ $\frac{2}{3} \times \frac{1}{8}$ $\frac{1}{12}$ $\frac{3}{4}$ of $\frac{1}{4}$ $\frac{3}{16}$

15. $\frac{1}{2} \times \frac{2}{5}$ $\frac{1}{5}$ $\frac{1}{3} \times \frac{5}{8}$ $\frac{5}{24}$ $\frac{3}{4} \times \frac{1}{3}$ $\frac{1}{4}$ $\frac{1}{2} \times \frac{3}{8}$ $\frac{3}{16}$ $\frac{2}{3}$ of $\frac{3}{4}$ $\frac{1}{2}$

16. $\frac{1}{3} \times \frac{2}{3}$ $\frac{2}{9}$ $\frac{1}{5} \times \frac{1}{6}$ $\frac{1}{30}$ $\frac{1}{6} \times \frac{2}{3}$ $\frac{1}{9}$ $\frac{3}{4} \times \frac{3}{4}$ $\frac{9}{16}$ $\frac{1}{4}$ of $\frac{4}{5}$ $\frac{1}{5}$

Do problems orally with class, letting different ones read problems and others show work at board. Assign ex. 8–16 as independent work. Check pupils as they work to be sure all have good understanding.

Present multiplication of fraction by fraction in which cancellation is used (pages 103-104).

Cancellation

1. **Problem** When you change $\frac{10}{12}$ to lowest terms, you divide both 10 and 12 by 2, which gives $\frac{5}{6}$. Sometimes the work is done by cancellation, as shown below.

Explanation First divide 10 by 2, which gives 5; cross out 10 and write 5 above it. Then divide 12 by 2; cross out 12 and write 6 below it. The answer is $\frac{5}{6}$. When you divide both 10 and 12 by 2, you say that you **cancel** 2. To cancel 2 means to **divide** both numerator and denominator by 2. Stress.

$$\frac{\overset{5}{\cancel{10}}}{\underset{6}{\cancel{12}}} = \frac{5}{6}$$

2. Change to lowest terms: $\frac{12}{16}$, $\frac{8}{10}$, $\frac{9}{15}$, $\frac{15}{20}$, $\frac{4}{6}$, $\frac{12}{18}$, $\frac{21}{24}$. $\frac{3}{4}$ $\frac{4}{5}$ $\frac{3}{5}$ $\frac{3}{4}$ $\frac{2}{3}$ $\frac{2}{3}$ $\frac{7}{8}$

3. **Problem** Multiply $\frac{7}{8}$ by $\frac{2}{3}$. 2 was canceled; 10 and 12 were not.

Explanation You can do the work in two different ways. In the first way, shown at A, multiply the numerators and denominators as usual, which gives $\frac{14}{24}$. Then change $\frac{14}{24}$ to $\frac{7}{12}$ by canceling 2 from 14 and 24. The answer is $\frac{7}{12}$. Think the step inside the dotted lines but do not write it.

A

$$\frac{2}{3} \times \frac{7}{8} = \boxed{\frac{2 \times 7}{3 \times 8}} = \frac{\overset{7}{\cancel{14}}}{\underset{12}{\cancel{24}}} = \frac{7}{12}$$

B

$$\frac{\overset{1}{\cancel{2}}}{3} \times \frac{7}{\underset{4}{\cancel{8}}} = \boxed{\frac{1 \times 7}{3 \times 4}} = \frac{7}{12}$$

In the second way, shown at B, first cancel 2 from 2 and 8. Think, "2 ÷ 2 = 1"; cross out 2 and write 1 above it. Think, "8 ÷ 2 = 4"; cross out 8 and write 4 below it. Stress. Then multiply as shown inside the dotted lines. The answer $\frac{7}{12}$ is already in lowest terms since you divided both 2 and 8 by 2 before you multiplied. Emphasize that in B we are merely changing answer to lowest terms "in advance."

4. **Problem** Find the answer to $4 \times \frac{3}{4}$. 3

Explanation Write 4 as $\frac{4}{1}$ and do the work as shown here: Stress.

$$4 \times \frac{3}{4} = \frac{\overset{1}{\cancel{4}}}{1} \times \frac{3}{\underset{1}{\cancel{4}}} = \boxed{\frac{1 \times 3}{1 \times 1}} = \frac{3}{1} = 3$$

In discussing these illustrative examples emphasize that cancellation is merely application of principle of fractions (you can divide both numerator and denominator of fraction by same number and get another fraction having same value).

Some teachers prefer not to use word cancel, but have pupils speak always of "dividing" both numerator and denominator by same number. If "cancel" is used, stress that it means "divide" in fraction work.

Using Cancellation

1. **Problem** Nancy's recipe for spice cupcakes calls for $\frac{2}{3}$ cup of milk. When Nancy makes $\frac{3}{4}$ of her recipe for cupcakes, she needs to find $\frac{3}{4}$ of $\frac{2}{3}$ cup of milk. How much milk does Nancy use in $\frac{3}{4}$ of her recipe? $\frac{1}{2}$

Explanation Remember that $\frac{3}{4}$ of $\frac{2}{3}$ means $\frac{3}{4} \times \frac{2}{3}$. In this example you need to cancel twice. First divide 2 and 4 by 2; then divide 3 and 3 by 3. Nancy needs $\frac{1}{2}$ cup of milk.

$$\frac{\overset{1}{\cancel{3}}}{\underset{2}{\cancel{4}}} \times \frac{\overset{1}{\cancel{2}}}{\underset{1}{\cancel{3}}} = \boxed{\frac{1 \times 1}{2 \times 1}} = \frac{1}{2}$$

2. How much milk does Nancy need if she makes $\frac{1}{2}$ of her recipe for spice cupcakes? $\frac{1}{3}$ cup

Multiply. Check your work by going over it: Have pupils explain answers.

3. $\frac{5}{6} \times \frac{3}{5}$ $\frac{1}{2}$ $\frac{2}{3} \times \frac{3}{16}$ $\frac{1}{8}$ $10 \times \frac{1}{5}$ 2 $\frac{1}{6} \times \frac{3}{16}$ $\frac{1}{32}$ $\frac{2}{5} \times \frac{5}{16}$ $\frac{1}{8}$

4. $\frac{1}{2} \times \frac{2}{3}$ $\frac{1}{3}$ $\frac{3}{4} \times \frac{11}{12}$ $\frac{11}{16}$ $\frac{9}{16} \times \frac{4}{5}$ $\frac{9}{20}$ $\frac{2}{3} \times \frac{5}{12}$ $\frac{5}{18}$ $\frac{2}{3} \times \frac{7}{16}$ $\frac{7}{24}$

5. $\frac{3}{4} \times \frac{5}{6}$ $\frac{5}{8}$ $\frac{5}{6} \times \frac{3}{10}$ $\frac{1}{4}$ $18 \times \frac{2}{3}$ 12 $\frac{3}{4} \times \frac{1}{12}$ $\frac{1}{16}$ $\frac{2}{5} \times \frac{5}{12}$ $\frac{1}{6}$

6. $\frac{1}{6} \times \frac{3}{4}$ $\frac{1}{8}$ $5 \times \frac{1}{10}$ $\frac{1}{2}$ $\frac{5}{12} \times \frac{2}{5}$ $\frac{1}{6}$ $4 \times \frac{3}{16}$ $\frac{3}{4}$ $\frac{2}{3} \times \frac{9}{16}$ $\frac{3}{8}$

7. $4 \times \frac{3}{8}$ $1\frac{1}{2}$ $4 \times \frac{7}{16}$ $1\frac{3}{4}$ $\frac{3}{16} \times \frac{5}{6}$ $\frac{5}{32}$ $\frac{1}{3} \times \frac{9}{10}$ $\frac{3}{10}$ $\frac{3}{5} \times \frac{7}{12}$ $\frac{7}{20}$

8. $\frac{5}{8} \times \frac{2}{3}$ $\frac{5}{12}$ $\frac{2}{3} \times \frac{3}{10}$ $\frac{1}{5}$ $20 \times \frac{3}{4}$ 15 $\frac{3}{5} \times \frac{5}{12}$ $\frac{1}{4}$ $8 \times \frac{11}{16}$ $5\frac{1}{2}$

9. $\frac{1}{3} \times \frac{3}{4}$ $\frac{1}{4}$ $\frac{5}{6} \times \frac{3}{16}$ $\frac{5}{32}$ $\frac{1}{12} \times \frac{2}{3}$ $\frac{1}{18}$ $8 \times \frac{3}{16}$ $1\frac{1}{2}$ $\frac{5}{6} \times \frac{1}{10}$ $\frac{1}{12}$

10. $\frac{4}{5} \times \frac{5}{8}$ $\frac{1}{2}$ $\frac{3}{4} \times \frac{7}{12}$ $\frac{7}{16}$ $\frac{3}{10} \times \frac{5}{6}$ $\frac{1}{4}$ $\frac{3}{5} \times 10$ 6 $6 \times \frac{1}{12}$ $\frac{1}{2}$

11. $\frac{2}{3} \times \frac{3}{8}$ $\frac{1}{4}$ $\frac{5}{8} \times \frac{1}{10}$ $\frac{1}{16}$ $\frac{9}{10} \times \frac{2}{3}$ $\frac{3}{5}$ $\frac{4}{5} \times \frac{5}{16}$ $\frac{1}{4}$ $\frac{1}{3} \times \frac{3}{10}$ $\frac{1}{10}$

Emphasize.

When you cancel in multiplying fractions, you divide a numerator of one fraction and a denominator of the other fraction each by the same number.

In discussing ex. 1 emphasize showing result of cancellation immediately (writing the 1 above 3, and so on). Do ex. 2–3 with class. Then assign ex. 4–11 as independent work if there are no difficulties. Check pupils as they work.

Extend work on pages 103–104 to include more difficult cancellation where cancelled number is not term of either fraction. Have more advanced pupils make up problems using numbers in ex. 8–9 while you work with others.

How Far Did Ann Walk?

1 **Problem** It is $\frac{5}{8}$ mi. from Ann's house to school. Last week Ann walked this distance 6 times because her bicycle needed repairs. How many miles was that? $3\frac{3}{4}$

Explanation First write 6 as $\frac{6}{1}$. Divide 6 and 8 each by 2. Think, "6 ÷ 2 = 3"; cross out 6 and write 3. Think, "8 ÷ 2 = 4"; cross out 8 and write 4. How many miles did Ann walk?

$$6 \times \frac{5}{8} = \frac{\overset{3}{\cancel{6}}}{1} \times \frac{5}{\underset{4}{\cancel{8}}} = \frac{15}{4} = 3\tfrac{3}{4}$$

2. Explain the work in each example and find the answer:

$$\frac{5}{12} \times \frac{9}{10} = \frac{\overset{1}{\cancel{5}}}{\underset{4}{\cancel{12}}} \times \frac{\overset{3}{\cancel{9}}}{\underset{2}{\cancel{10}}} = ?\ \frac{3}{8} \qquad \frac{14}{15} \times \frac{10}{21} = \frac{\overset{2}{\cancel{14}}}{\underset{3}{\cancel{15}}} \times \frac{\overset{2}{\cancel{10}}}{\underset{3}{\cancel{21}}} = ?\ \frac{4}{9}$$

Do ex. 3–4 as class activity. Then assign ex. 5–9 as independent work. Note difficulties.

Multiply. Check your work by going over it:

3. $8 \times \frac{1}{6}$ $1\frac{1}{3}$ $\frac{3}{8} \times 18$ $6\frac{3}{4}$ $\frac{8}{15} \times \frac{3}{10}$ $\frac{4}{25}$ $\frac{5}{8} \times 12$ $7\frac{1}{2}$ $\frac{5}{6} \times \frac{9}{16}$ $\frac{15}{32}$

4. $\frac{7}{8} \times \frac{6}{7}$ $\frac{3}{4}$ $8 \times \frac{3}{10}$ $2\frac{2}{5}$ $\frac{5}{16} \times 24$ $7\frac{1}{2}$ $9 \times \frac{5}{12}$ $3\frac{3}{4}$ $\frac{8}{3} \times \frac{11}{12}$ $2\frac{4}{9}$

5. $9 \times \frac{5}{6}$ $7\frac{1}{2}$ $\frac{7}{8} \times 20$ $17\frac{1}{2}$ $\frac{5}{12} \times \frac{9}{10}$ $\frac{3}{8}$ $8 \times \frac{7}{10}$ $5\frac{3}{5}$ $\frac{1}{6} \times \frac{15}{16}$ $\frac{5}{32}$

6. $\frac{4}{5} \times \frac{5}{6}$ $\frac{2}{3}$ $\frac{3}{4} \times \frac{10}{9}$ $\frac{5}{6}$ $\frac{15}{16} \times \frac{3}{10}$ $\frac{9}{32}$ $\frac{5}{6} \times \frac{4}{15}$ $\frac{2}{9}$ $\frac{3}{8} \times \frac{10}{21}$ $\frac{5}{28}$

7. $\frac{1}{6} \times 9$ $1\frac{1}{2}$ $\frac{8}{9} \times \frac{9}{10}$ $\frac{4}{5}$ $\frac{10}{21} \times \frac{15}{16}$ $\frac{25}{56}$ $\frac{3}{8} \times 12$ $4\frac{1}{2}$ $\frac{1}{6} \times \frac{9}{10}$ $\frac{3}{20}$

8. $\frac{5}{6} \times 8$ $6\frac{2}{3}$ $\frac{3}{4} \times 10$ $7\frac{1}{2}$ $\frac{9}{10} \times \frac{8}{15}$ $\frac{12}{25}$ $\frac{4}{5} \times \frac{1}{10}$ $\frac{2}{25}$ $4 \times \frac{7}{10}$ $2\frac{4}{5}$

9. $\frac{3}{4} \times 6$ $4\frac{1}{2}$ $6 \times \frac{5}{16}$ $1\frac{7}{8}$ $\frac{7}{12} \times 18$ $10\frac{1}{2}$ $9 \times \frac{7}{12}$ $5\frac{1}{4}$ $\frac{5}{6} \times 15$ $12\frac{1}{2}$

More Practice. See ㉑ on page 317.

Present problems containing fractions.

Review Problems

1. When Susan makes cocoa she allows $\frac{3}{4}$ teaspoon of sugar for each cup of cocoa. How many teaspoons of sugar does she need for 20 cups of cocoa? 15 for 6 cups of cocoa? $4\frac{1}{2}$

2. Susan uses $\frac{1}{4}$ cup of water and $\frac{3}{4}$ cup of milk for each cup of cocoa. How many cups of water and how many cups of milk does she need for 20 cups of cocoa? for 6 cups?
   5 cups of water, 15 cups of milk
   $1\frac{1}{2}$ cups of water, $4\frac{1}{2}$ cups of milk

3. Jack had \$2.75 cash on hand at the beginning of last week. Here is his record for money received and spent last week. Received: \$.50, \$1.75, \$1.40, \$.75. Spent: \$.19, \$.25, \$2.13, \$.69, \$.08. Find Jack's balance at the end of last week. \$3.81

4. Mr. Hunt drove his car 1500 mi. in 2 weeks. About how many miles, on the average, did he drive per day? About 107

5. Mrs. Field has a $4\frac{1}{2}$-pound roast she wants to be ready at 5:45 P.M. She allows 20 min. to the pound to cook it. At what time should she put the roast in the oven? 4:15 P.M.

6. Mr. Johnson pays Tom at the end of each week for the help Tom gives him. He pays Tom 60¢ an hour. Tom added these hours to find the amount he had earned last week: $1\frac{3}{4}$ hr., 2 hr., $2\frac{1}{4}$ hr., $1\frac{1}{2}$ hr., $2\frac{1}{2}$ hr., $5\frac{1}{4}$ hr. How much was it? \$9.15

7. At the store Judy bought 5 lb. of potatoes at \$.07 a pound, $\frac{1}{2}$ lb. of cheese at \$.80 a pound, and a basket of berries for \$.45. How much did Judy spend? \$1.20

8. There were 35 passengers on an airplane trip. Each one paid \$69.85 for his ticket. How much did they pay in all? \$2444.75

9. George arrived at the bus station at 4:50 to meet his mother who was coming on the 5:04 bus. The bus came in 17 min. late. How many minutes did George wait at the station? 31

10. Ann paid \$.95 a yard for $2\frac{1}{2}$ yd. of cotton cloth, \$.55 for a pattern, and \$.30 for buttons. Then she had \$.19 left. How much did Ann have before she bought these things? \$3.42

11. Our class party cost \$17.60. The 32 members of the class shared the cost equally. How much did each one pay? \$.55

Check papers and analyze errors. Try to determine if they are caused by lack of understanding of fractions, processes, carelessness, and so on. Group pupils who had errors to help them clear up difficulties.

Present second set of improvement tests
in addition and review arithmetical terms.

Improving by Practice

Addition Test 2a. Time: 4 min.

1.	575	437	787	878	408	994	
	154	576	564	331	793	667	
	617	756	635	468	946	380	
	262	594	788	395	136	424	
	438	623	128	509	494	278	⑥
	2046	2986	2902	2581	2777	2743	

Addition Test 2b. Time: 4 min.

2.	469	359	648	458	462	538	
	722	914	706	948	277	651	
	588	322	840	736	914	756	
	813	279	561	579	992	131	
	459	236	347	628	156	129	⑥
	3051	2110	3102	3349	2801	2205	

Addition Test 2c. Time: 4 min.

3.	212	132	724	168	496	474	
	539	277	375	683	551	393	
	358	218	957	644	865	835	
	883	920	479	674	670	104	
	345	353	519	478	339	539	⑥
	2337	1900	3054	2647	2921	2345	

The Language of Arithmetic

Show that you know what each word or group of words means by using it in a sentence or by giving an example of it:

4. check

5. billion

6. divisor

7. account

8. addend

9. balance

10. quotient

11. formula

12. difference

13. perimeter

14. dimensions

15. subtrahend

16. cancellation

17. place value

18. lowest terms

19. factor

20. mixed number

21. proper fraction

Tests should be given, scored, recorded in same way as first set; see pages 54-58. Group pupils who had errors to help them determine causes. Review, further, terms in ex. 4-21 which pupils are unsure of. Have them make study cards (see page 99).

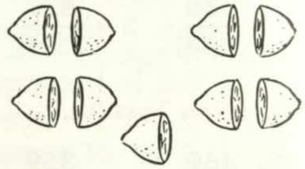
Teach how to change mixed number to improper fraction, as preparation for multiplication of mixed numbers.

Changing Mixed Numbers

1. **Problem** Jean has $4\frac{1}{2}$ lemons. How many glasses of lemonade can Jean make from $4\frac{1}{2}$ lemons if she uses $\frac{1}{2}$ lemon for each glass of lemonade? 9

Explanation You must change $4\frac{1}{2}$ lemons to halves of a lemon.

Since there are 2 halves in 1 whole lemon, there are 8 halves in 4 whole lemons. So $4 = \frac{8}{2}$. Then $4\frac{1}{2} = \frac{8}{2} + \frac{1}{2}$, or $\frac{9}{2}$. This shows that $4\frac{1}{2}$ lemons will make 9 halves of a lemon. Jean can make 9 glasses of lemonade.



An easy way to change $4\frac{1}{2}$ to $\frac{9}{2}$ is to multiply 4 by 2 and add 1, which gives 9. Then write 9 over 2, which gives $\frac{9}{2}$.

Point out that the 2 in "4 by 2" means 2 halves.

To change a mixed number to an improper fraction, multiply the whole number by the denominator, add the numerator, and place the result over the denominator.

Have pupils use diagrams to prove some answers in ex. 2–9.

Tell what number is missing in each numerator:

2. $3\frac{1}{2} = \frac{?}{2}$ 7 $6\frac{3}{8} = \frac{?}{8}$ 51 $2\frac{4}{5} = \frac{?}{5}$ 14 $7\frac{2}{3} = \frac{?}{3}$ 23 $4\frac{5}{12} = \frac{?}{12}$ 53

3. $4\frac{1}{5} = \frac{?}{5}$ 21 $5\frac{2}{3} = \frac{?}{3}$ 17 $8\frac{7}{8} = \frac{?}{8}$ 71 $9\frac{1}{4} = \frac{?}{4}$ 37 $6\frac{7}{10} = \frac{?}{10}$ 67

4. $2\frac{1}{3} = \frac{?}{3}$ 7 $3\frac{3}{4} = \frac{?}{4}$ 15 $7\frac{1}{6} = \frac{?}{6}$ 43 $4\frac{5}{8} = \frac{?}{8}$ 37 $1\frac{9}{16} = \frac{?}{16}$ 25

5. $1\frac{1}{4} = \frac{?}{4}$ 5 $2\frac{5}{6} = \frac{?}{6}$ 17 $8\frac{1}{2} = \frac{?}{2}$ 17 $5\frac{3}{5} = \frac{?}{5}$ 28 $9\frac{9}{10} = \frac{?}{10}$ 99

Be sure pupils understand "why" they multiply whole numbers by denominator.

Change these mixed numbers to improper fractions:

6. $4\frac{1}{2}$ $\frac{9}{2}$ $8\frac{1}{6}$ $\frac{49}{6}$ $10\frac{2}{5}$ $\frac{52}{5}$ $2\frac{4}{7}$ $\frac{18}{7}$ $9\frac{1}{8}$ $\frac{73}{8}$ $4\frac{4}{5}$ $\frac{24}{5}$ $6\frac{2}{3}$ $\frac{20}{3}$ $4\frac{1}{10}$ $\frac{41}{10}$

7. $8\frac{1}{4}$ $\frac{33}{4}$ $3\frac{3}{8}$ $\frac{27}{8}$ $12\frac{1}{3}$ $\frac{37}{3}$ $9\frac{1}{6}$ $\frac{55}{6}$ $6\frac{3}{4}$ $\frac{27}{4}$ $3\frac{7}{8}$ $\frac{31}{8}$ $5\frac{3}{4}$ $\frac{23}{4}$ $2\frac{11}{12}$ $\frac{35}{12}$

8. $2\frac{3}{5}$ $\frac{13}{5}$ $1\frac{7}{8}$ $\frac{15}{8}$ $11\frac{1}{8}$ $\frac{89}{8}$ $3\frac{1}{5}$ $\frac{16}{5}$ $4\frac{5}{6}$ $\frac{29}{6}$ $9\frac{2}{3}$ $\frac{29}{3}$ $7\frac{1}{2}$ $\frac{15}{2}$ $1\frac{3}{16}$ $\frac{19}{16}$

9. $3\frac{1}{7}$ $\frac{22}{7}$ $7\frac{1}{5}$ $\frac{36}{5}$ $15\frac{1}{4}$ $\frac{61}{4}$ $1\frac{5}{8}$ $\frac{13}{8}$ $5\frac{4}{5}$ $\frac{29}{5}$ $6\frac{2}{5}$ $\frac{32}{5}$ $8\frac{1}{8}$ $\frac{65}{8}$ $7\frac{1}{12}$ $\frac{85}{12}$

In explaining ex. 1 use addition first ($\frac{2}{2} + \frac{2}{2} + \frac{2}{2} + \frac{2}{2}$) to show that there are 8 halves in 4 wholes. Then lead pupils to suggest multiplication ($4 \times \frac{2}{2} = \frac{8}{2}$, $\frac{8}{2} + \frac{1}{2} = \frac{9}{2}$). Do few more examples this way. Then present short cut.

Teach multiplication of mixed numbers by fractions or mixed numbers (pages 109–110).

The Cost of Electricity

1. **Problem** In Bay City it costs $2\frac{1}{4}$¢ per hour for electricity to run an electric toaster. Suppose a family uses the toaster $\frac{2}{3}$ hr. per week for breakfast. How much does that family pay per week to run the toaster for breakfast? $1\frac{1}{2}$¢

Explanation Find $\frac{2}{3}$ of $2\frac{1}{4}$. Change $2\frac{1}{4}$ to $\frac{9}{4}$. Then multiply $\frac{9}{4}$ by $\frac{2}{3}$. You can cancel in this example. It costs $1\frac{1}{2}$¢ in all.

$$\frac{2}{3} \times 2\frac{1}{4} = \frac{\overset{1}{\cancel{2}}}{\underset{1}{\cancel{3}}} \times \frac{\overset{3}{\cancel{9}}}{\underset{2}{\cancel{4}}} = \frac{3}{2} = 1\frac{1}{2}$$

2. **Problem** It costs $\frac{1}{5}$¢ per hour for electricity to light a small electric lamp. How much does it cost to light the lamp for $2\frac{1}{2}$ hr.? $\frac{1}{2}$¢ It costs $1\frac{1}{5}$¢ per hour for electricity to run a big fan. How much does it cost to run the fan for $7\frac{1}{2}$ hr.? 9¢

Explanation The cost of using the lamp for $2\frac{1}{2}$ hr. and of using the fan for $7\frac{1}{2}$ hr. is worked out below. Explain the work for each example. What is the cost of using the lamp? $\frac{1}{2}$¢ the fan? 9¢

$$2\frac{1}{2} \times \frac{1}{5} = \frac{\overset{1}{\cancel{5}}}{2} \times \frac{1}{\underset{1}{\cancel{5}}} = \frac{1}{2} \qquad 7\frac{1}{2} \times 1\frac{1}{5} = \frac{\overset{3}{\cancel{15}}}{\underset{1}{\cancel{2}}} \times \frac{\overset{3}{\cancel{6}}}{\underset{1}{\cancel{5}}} = \frac{9}{1} = 9$$

If a factor of a product is a mixed number, you often change it to an improper fraction before you multiply.

3. It costs $3\frac{1}{3}$¢ per hour for electricity to use an electric iron. What does it cost to use the iron 18 min.? 1¢ 18 min. = $\frac{3}{10}$ hr. What is $\frac{3}{10} \times 3\frac{1}{3}$¢? 1¢ Jim worked this problem as shown below at the left. His answer is 1¢ and it is right.

$$\frac{\overset{1}{\cancel{3}}}{\underset{1}{\cancel{10}}} \times \frac{\overset{1}{\cancel{10}}}{\underset{1}{\cancel{3}}} = \frac{1 \times 1}{1 \times 1} = 1 \qquad \frac{\cancel{3}}{\cancel{10}} \times \frac{\cancel{10}}{\cancel{3}} = 0$$

Andy did the work as shown above at the right. He did not write the 1's, so he said that the answer is 0 because everything is canceled. Why is Andy wrong?

Discuss the model examples thoroughly with pupils. Emphasize that they change mixed number to improper fraction first, then multiply. Stress importance of writing 1's, and so on, when pupils cancel.

Emphasize importance of writing the 1's, and so on, when pupils cancel.

Problems and Practice

1. It takes Bob $1\frac{1}{2}$ hr. to mow the lawn with the new mower. Jack has agreed to use the mower $\frac{1}{2}$ of the time today. How long should Jack mow today? $\frac{3}{4}$ hr.

2. Dick and Fred are going to ride their bicycles to Clear Lake. The distance to the lake is $13\frac{1}{2}$ mi. They plan to stop to eat their lunch after riding $\frac{1}{2}$ of the distance. How far should they ride before lunch? $6\frac{3}{4}$ mi.

3. Betty wants to make chocolate candy that calls for $2\frac{1}{2}$ cups of sugar. She plans to make only $\frac{1}{2}$ the recipe. How many cups of sugar should Betty use? $1\frac{1}{4}$

4. Suppose Betty wanted to make $1\frac{1}{2}$ times the recipe for chocolate candy. How much sugar should she use? See ex. 3.

Pupils should show work as in ex. 1-3 on page 109. $3\frac{3}{4}$ cups

Multiply. Cancel when you can. Check the work by going over it:

5. $\frac{2}{5} \times 4\frac{3}{8}$ $1\frac{3}{4}$ $1\frac{7}{8} \times 3\frac{1}{3}$ $6\frac{1}{4}$ $1\frac{1}{5} \times \frac{1}{6}$ $\frac{1}{5}$ $1\frac{1}{2} \times 2\frac{1}{2}$ $3\frac{3}{4}$

6. $\frac{5}{6} \times 2\frac{5}{8}$ $2\frac{3}{16}$ $1\frac{1}{5} \times \frac{5}{12}$ $\frac{1}{2}$ $4\frac{4}{5} \times \frac{3}{8}$ $1\frac{4}{5}$ $\frac{9}{10} \times 2\frac{2}{3}$ $2\frac{2}{5}$

7. $\frac{3}{4} \times 6\frac{2}{3}$ 5 $\frac{9}{16} \times 1\frac{1}{3}$ $\frac{3}{4}$ $2\frac{2}{3} \times \frac{3}{4}$ 2 $\frac{5}{12} \times 1\frac{1}{5}$ $\frac{1}{2}$

8. $\frac{1}{6} \times 2\frac{1}{4}$ $\frac{3}{8}$ $3\frac{1}{2} \times 2\frac{1}{2}$ $8\frac{3}{4}$ $2\frac{1}{2} \times \frac{1}{5}$ $\frac{1}{2}$ $\frac{3}{10} \times 2\frac{1}{2}$ $\frac{3}{4}$

9. $\frac{2}{3} \times 1\frac{1}{2}$ 1 $\frac{1}{10} \times 2\frac{1}{2}$ $\frac{1}{4}$ $1\frac{3}{5} \times \frac{1}{8}$ $\frac{1}{5}$ $3\frac{3}{4} \times 2\frac{2}{3}$ 10

10. $\frac{3}{8} \times 2\frac{2}{3}$ 1 $4\frac{1}{2} \times 2\frac{2}{3}$ 12 $2\frac{2}{3} \times \frac{1}{6}$ $\frac{4}{9}$ $1\frac{1}{4} \times 1\frac{3}{5}$ 2

11. $\frac{3}{4} \times 5\frac{1}{3}$ 4 $1\frac{1}{2} \times 1\frac{1}{6}$ $1\frac{3}{4}$ $2\frac{1}{2} \times \frac{5}{8}$ $1\frac{9}{16}$ $1\frac{1}{3} \times \frac{3}{10}$ $\frac{2}{5}$

12. $\frac{3}{4} \times 1\frac{1}{6}$ $\frac{7}{8}$ $3\frac{1}{7} \times 5\frac{1}{4}$ $16\frac{1}{2}$ $1\frac{1}{5} \times \frac{5}{6}$ 1 $2\frac{1}{4} \times 1\frac{1}{3}$ 3

13. $\frac{4}{5} \times 1\frac{3}{4}$ $1\frac{2}{5}$ $1\frac{1}{8} \times 3\frac{1}{3}$ $3\frac{3}{4}$ $1\frac{1}{4} \times \frac{3}{8}$ $\frac{15}{32}$ $7\frac{1}{2} \times 1\frac{1}{3}$ 10

More Practice. See ㉒ on page 317.

Do problems orally letting different pupils explain work at blackboard. If there are no apparent difficulties assign ex. 5-13 as independent work. Remind pupils to change mixed numbers to improper fractions before multiplying.

Reteach method for finding areas. See G-46, 47 for important prelesson activities in which pupil uses own cardboard square inch and square foot to discover areas of various rectangles and squares.

Measuring Areas

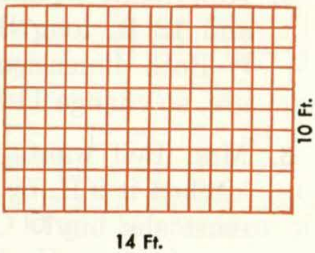
1. A square and a rectangle are shown below. Each of these figures has four sides and four **square corners.** The square corners are called **right angles.** All four sides of a square are the same length. Stress.

2. To measure the **length** and **width** of a rectangle, you use linear measure. If it is a small rectangle, like a sheet of paper, you find the dimensions in **inches.** If it is a large rectangle, like a floor, you find the dimensions in **feet.**

3. To measure the **area** of a square or a rectangle, you use square measure and find how many **square inches** or **square feet** it contains. A **square inch** is a square having each side 1 in. long. A **square foot** is a square having each side 1 ft. long. What is a square yard? A square having each side 1 yd. long

4. Ted wants to paint the floor of his room. It is 10 ft. by 14 ft. To find how many square feet of floor he has to paint, he made a drawing like the one at the right. There are 14 square feet in the top row and there are 10 rows in all. So the area of the floor of Ted's room is 10 × 14 sq. ft., or 140 sq. ft. **To find the area of a rectangle, multiply its length by its width.** The length and width of the rectangle must **both** be expressed in the same units of linear measure.

Stress.



5. If you let **l** stand for the length of a rectangle, **w** for its width, and **A** for its area, the formula for the area of the rectangle is:

$$A = lw$$

You must remember that **lw** means **l** × **w**.

Demonstrate that area is amount of space a surface covers or contains. To point out why square is used as unit for expressing area (its use is easiest way to completely cover rectangular surface) have pupils try to cover rectangles with circles, triangles, and so on.

Reteach computation of area without drawing square measure.

Square Measure

1. The Wells boys are painting the floor of their playroom. The dimensions of the room are 12 ft. by 18 ft. How many square feet of floor must the boys paint? 216

2. How many yards wide is the room in ex. 1? 4 How many yards long is it? 6 How many square yards of floor are there? 24

3. Mr. Lewis wants to paint the floor of the sun porch which is 8 ft. wide and 12 ft. long. For how many square feet of floor must he buy paint? 96

4. How many square feet are there in a floor 11 ft. 8 in. wide and 12 ft. long? 140

▶ Both dimensions must be given in the same unit of measure, so change 11 ft. 8 in. to $11\frac{2}{3}$ ft.; then multiply $11\frac{2}{3}$ by 12.

5. Mrs. Bell wants new linoleum for the kitchen floor. The kitchen is 9 ft. by 15 ft. How many square yards of linoleum must she buy? 15 Change both dimensions to yards.

Find the areas of these rectangles. Before multiplying express both dimensions in the same unit: Emphasize.

6. 9 in. × 11 in. 99 sq in. 4 ft. 6 in. × 18 ft. 81 sq. ft. 7 yd. 2 ft. × 12 yd. 92 sq. yd.

7. 3 ft. × 48 in. 12 sq. ft. 5 ft. 9 in. × 16 ft. 92 sq. ft. 4 yd. 1 ft. × 18 yd. 78 sq. yd.

8. 5 yd. × 18 ft. 30 sq. yd. 9 ft. 4 in. × 15 ft. 140 sq. ft. 2 yd. 1 ft. × 15 yd. 35 sq. yd.

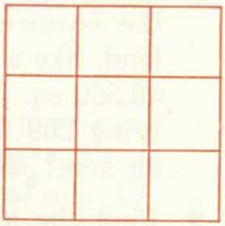
9. 9 ft. × 60 ft. 540 sq. ft. 6 ft. 3 in. × 20 ft. 125 sq. ft. 9 yd. 2 ft. × 18 yd. 174 sq. yd.

Have pupils draw diagrams of areas to be determined in ex. 1-9. If pupils do not understand why both dimensions must be in same units, discuss how they found area on page 111. Then ask what the unit of square measure would be if length were in inches and width in feet.

Provide readiness for understanding table of square measure.

Square Measure

1. On the board draw a square that has each side 1 yd. long. How many feet long is each side? 3 Mark off each side in feet and draw lines as shown at the right. How many square feet have you made? 9 How many square feet are there in 1 sq. yd.? 9 How many square feet are there in 8 sq. yd.? 72 in 5 sq. yd.? 45


1 Sq. Yd.

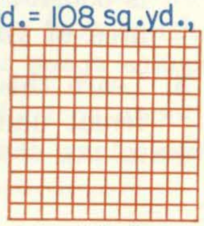
2. A room is 12 ft. wide and 15 ft. long. What is the area of the room in square yards? 20

▶ Bill found the area in square feet and said it was 180 sq. ft. Then he divided by 9 and said there were 20 sq. yd. in it. Mary changed 12 ft. and 15 ft. both to yards. She then found the area in square yards. Did Bill and Mary agree? Yes

Be sure pupils understand "why" Bill divided by 9.

3. A garden is 9 yd. wide and 12 yd. long. Find the area of the garden in square feet. Use two different ways to find the number of square feet in the area. 9 yd. x 12 yd. = 108 sq. yd., 9 x 108 = 972 (sq. ft.); 27 ft. x 36 ft. = 972 sq. ft.

4. On a large piece of paper or on the board draw a square that has each side 1 ft. long. How many inches long is each side? 12 Mark off each side in inches and draw lines as shown at the right. How many square inches are there in 1 row? 12 How many rows are there? 12 How many are 12 × 12 sq. in.? 144 sq. in. How many square inches are there in 1 sq. ft.? 144 in $\frac{1}{2}$ sq. ft.? 72


1 Sq. Ft.

Extend work to find number of square inches in square yard.

5. A tablecloth is 36 in. wide and 54 in. long. Is the area of this cloth more or less than 13 sq. ft.? More How much more or less is it? $\frac{1}{2}$ sq. ft. more First change the dimensions to feet.

Find the numbers that go in the spaces:

6. 3 sq. yd. = . . . 27 sq. ft.   11 sq. ft. = . . . 1584 sq. in.

7. 6 sq. yd. = . . . 54 sq. ft.   18 sq. ft. = . . . 2 sq. yd.

8. 3 sq. ft. = . . . 432 sq. in.   45 sq. ft. = . . . 5 sq. yd.

Follow development as given on this page and have pupils perform actions called for in ex. 1 and 4. You might have pupils use their foot or inch squares to cover the surfaces
Have pupils make up other problems like ex. 2, 3, 5.

Introduce table of square measure and acquaint pupils with terms "acre" and "square mile."

How Land Is Measured

1. A small piece of land, like a building lot, is measured by the **square foot** or the **square yard.** A larger piece of land, like a farm, is measured by the **acre.** An acre contains 43,560 sq. ft. Find the area of a square piece of land measuring 209 ft. on each side. 43,681 sq.ft. Does this square contain about an acre? Yes Is it a little more or a little less than an acre? A little more

2. Find the area of a square measuring 208 ft. on each side. 43,264 sq.ft. Is the area more or less than an acre? Less Which is closer to an acre, a square measuring 209 ft. on each side or one measuring 208 ft. on each side? 209 ft.

3. On the playground measure off a square that is 209 ft. on each side. This will give you an idea of the size of an acre.

4. Very large areas of land are measured by the **square mile.** The area of Rhode Island, the smallest state in the United States, is 1058 sq. mi. The area of Alaska, the largest state, is 586,400 sq. mi. How many square miles are there in the area of your state? If possible, indicate approximate limits of square space in vicinity of school that is 1 mile on a side.

5. Learn this table of square measure. It shows how the different units of square measure are related:

Make class chart.

144 square inches = 1 square foot (sq. ft.)
9 square feet = 1 square yard (sq. yd.)
43,560 square feet = 1 acre (A.)
640 acres = 1 square mile (sq. mi.)

6. Mr. Wood has a rectangular piece of land 150 ft. wide and 600 ft. long. Is this about 2 acres or 3 acres of land? About 2

7. A field containing $12\frac{1}{2}$ acres of land was sold at \$200 an acre. How much was paid for the field? \$ 2500

8. Mr. Chase built a house on a rectangular lot 180 ft. long and 121 ft. wide. What part of an acre is the lot? $\frac{1}{2}$

In discussing ex. 1 point out that size of object or space to be measured determines unit to be used. Perform action in ex. 3 to help develop understanding of acre. Do not have pupils memorize table; understanding is more important.

Present problems involving area and perimeter.

Using Measures in Problems

1. The distance around the deck of one ocean liner is 330 ft. To walk a mile should Mr. King go around this deck 15, 16, or 17 times? 16

2. Mrs. Jackson wants to cover the floor of the living room with carpet. The floor is 18 ft. wide and 25 ft. long. The carpet comes in strips 9 ft. wide. These strips are sold by the "running foot." If one buys 10 running feet of this carpet, one gets a piece 10 ft. long and 9 ft. wide. How many running feet of this carpet should Mrs. Jackson buy to have enough to cover the floor of the living room? 50 Find its cost at $7.95 per running foot. $ 397.50 Make a drawing to show how to cut the carpet and lay it on the floor so that the floor will be covered and there will be no waste.

3. Mary's father made a pen for her rabbits. It was 9 ft. wide and 12 ft. long. He bought wire to enclose the pen and allowed 1 ft. extra to join the wire. How many feet of wire did he use? 43 The wire is sold in rolls of 50 ft. How much wire did he have left over? 7 ft.

4. The deepest spot in the Pacific Ocean is said to be about 35,640 ft. deep. Is this spot nearer 6 mi. or 7 mi. below sea level? Nearer 7

5. Jim and Tom want to paint the floor of the game room. It is 16 ft. wide and 20 ft. long. One gallon of the floor paint they will buy covers up to 650 sq. ft. Could the boys put on 2 coats of paint if they buy 1 gal. of paint? 640 sq. ft.; yes

6. Mr. Case measured the old sidewalk in front of his house to find how many square yards it contains. The sidewalk is 5 ft. wide and 135 ft. long. How many square yards is that? 75

Tell the missing number:

7. 20 sq. ft. = 2880 sq. in. 36 sq. in. = $\frac{1}{4}$ sq. ft.

8. 27 sq. ft. = 3 sq. yd. 10 sq. yd. = 90 sq. ft.

9. 11 sq. ft. = 1584 sq. in. 81 sq. ft. = 9 sq. yd.

Be sure pupils understand difference between area and perimeter. Assign ex. 1-6 as independent work. When all are finished have volunteers explain answers at blackboard. Then have pupils do ex. 7-9, using table of square measure.

See G-49 for correlation of examples with aims.

Chapter Review

1. Change these mixed numbers to fractions:

$1\frac{3}{4}$ $\frac{7}{4}$ $7\frac{1}{2}$ $\frac{15}{2}$ $2\frac{7}{8}$ $\frac{23}{8}$ $4\frac{2}{3}$ $\frac{14}{3}$ $6\frac{7}{12}$ $\frac{79}{12}$ $1\frac{9}{16}$ $\frac{25}{16}$ $5\frac{3}{10}$ $\frac{53}{10}$

2. Change these fractions to lowest terms by cancellation:

$\frac{12}{15}$ $\frac{4}{5}$ $\frac{4}{18}$ $\frac{2}{9}$ $\frac{21}{28}$ $\frac{3}{4}$ $\frac{5}{15}$ $\frac{1}{3}$ $\frac{10}{45}$ $\frac{2}{9}$ $\frac{6}{21}$ $\frac{2}{7}$ $\frac{20}{36}$ $\frac{5}{9}$ $\frac{18}{48}$ $\frac{3}{8}$

3. Multiply and check the work:

$\frac{3}{8} \times 144$ 54 $4\frac{1}{2} \times 2\frac{2}{3}$ 12 $\frac{15}{16} \times \frac{12}{25}$ $\frac{9}{20}$ $1\frac{3}{4} \times 35$ $61\frac{1}{4}$

Find the perimeters(1) and the areas(2) of these rectangles. Be sure to express both dimensions in the same unit: Stress.

(1)
(2)

4. 8 ft. by 9 ft. 34 ft. 72 sq.ft.   4 ft. by 7 ft. 6 in. 23 ft. 30 sq.ft.   19″ × 30″ 98″ 570 sq.in.

5. 2 ft. by 6 yd. 40 ft. 36 sq.ft.   6 ft. by 8 ft. 4 in. $28\frac{2}{3}$ ft. 50 sq.ft.   8′ × 174′ 364′ 1392 sq.ft.

6. How do you change square feet to square inches? Multiply by 144

7. How do you change square feet to square yards? Divide by 9

8. How many feet are there in 8 yd.? 24 9 yd.? 27 15 yd.? 45

9. How many feet are there in 4 rd.? 66 7 rd.? $115\frac{1}{2}$ $16\frac{1}{2}$ ft. = 1 rd.

10. Is 10,125 ft. more or less than 2 mi.? Less How many feet more or less than 2 mi. is it? 435 ft. less 5280 ft. = 1 mi.

11. A rectangular piece of land is 145 ft. wide and 600 ft. long. Is its area more or less than 2 acres? Less How many square feet more or less than 2 acres is it? 120 sq. ft. less 43,560 sq. ft. = 1 acre.

12. There will be 48 children and teachers at the school party. When Ann ordered the ice cream she allowed $\frac{1}{2}$ pt. of ice cream for each person. How many gallons did she order? 3

13. In the candy store chocolate creams are \$1.20 a pound. How much should Jim pay for 8 oz. of this candy? \$.60 for 10 oz.? \$.75

14. In Newtown the cost for electricity to run a large fan is $1\frac{1}{3}$¢ an hour. Find the cost of running a fan for $4\frac{1}{2}$ hr. 6¢

15. It costs $\frac{3}{8}$¢ per hour to run an electric sewing machine. Find the cost of using the machine for 2 hr.; $\frac{3}{4}$¢ for 4 hr. $1\frac{1}{2}$¢

Check papers carefully and analyze types of errors. Group pupils who had mistakes to help them discover causes (lack of understanding of changing mixed numbers, cancellation, division errors, carelessness, problem situations).

A Problem Test

1. It is $\frac{1}{4}$ mi. around a running track. How far does Ted run if he goes around the track twice? if he goes around 4 times? 1 mi.
$\frac{2}{4}$ mi., or $\frac{1}{2}$ mi.

2. How many square feet are there in a floor 12 ft. 6 in. wide and 18 ft. long? 225

3. One week Henry worked for Mr. Hall $2\frac{1}{2}$ hr. on Wednesday afternoon and $5\frac{3}{4}$ hr. on Saturday. He was paid 60¢ per hour. How much did Mr. Hall pay Henry? $4.95

4. Jim read about two men who went up 72,395 ft. in a balloon. Was this almost 13 mi. or 14 mi. up in the air? Almost 14

5. A square field is $9\frac{1}{2}$ rd. on a side. How many feet long is one side of the field? $16\frac{1}{2}$ ft. = 1 rd.
$156\frac{3}{4}$

6. Mary made candy in a large pan. The candy weighed $2\frac{3}{4}$ lb. She gave half of it to George. What was the weight of George's candy? $1\frac{3}{8}$ lb.

7. Charles made a rectangular pen for his puppy. It was 6 ft. wide and 21 ft. long. How many feet of wire fence did he need for the pen? He allowed 1 ft. extra to join the wire. 55

8. The city laid a new sidewalk in front of the public library. The walk is 6 ft. wide and 144 ft. long. It cost $3.75 a square yard. Find the total cost of laying the walk. $ 360.00

9. Patty bought $1\frac{1}{2}$ lb. of cheese at $.79 a pound and 1 lb. of butter for $.65. How much change from $5.00 did the clerk give Patty? $ 3.16

10. A recipe for candy calls for $\frac{3}{4}$ cup of molasses. If Mother makes $1\frac{1}{2}$ times the recipe, how much molasses is needed? $1\frac{1}{8}$ cups

How many problems did you get right? Look below to find out what your score means. Be sure scores are recorded on pupils' graphs.

SCORE	0–5	6–7	8–9	10
	You need help	Fair	Good	Excellent

Discuss problems with pupils who made mistakes to try to determine causes, from their explanations. Plan for reteaching of processes or review as needed. Let other pupils work on original problems for arithmetic corner.

Present diagnostic test of fraction skills, with practice-page references.

How Much Have You Learned?

If you miss more than one example in a row, turn to the Practice Pages for that row.

Add and check the work: Practice Pages

1.

$$\begin{array}{rrrrr} 2\frac{1}{2} & 3\frac{4}{5} & 4\frac{2}{3} & 6\frac{3}{4} & 3\frac{7}{8} \\ 1\frac{3}{4} & 2\frac{3}{10} & 1\frac{1}{2} & 2\frac{5}{6} & 1\frac{1}{6} \\ 2\frac{5}{8} & 5\frac{1}{2} & 1\frac{2}{3} & 4\frac{1}{2} & 8\frac{2}{3} \\ \hline 6\frac{7}{8} & 11\frac{3}{5} & 7\frac{5}{6} & 14\frac{1}{12} & 13\frac{17}{24} \end{array}$$

64, 76

Subtract and check the work:

2.

$$\begin{array}{rrrrr} 6\frac{7}{8} & 4\frac{2}{5} & 7\frac{1}{2} & 3\frac{1}{6} & 9\frac{7}{10} \\ 3\frac{1}{4} & 2\frac{9}{10} & 5\frac{2}{3} & 2\frac{3}{4} & 3\frac{3}{4} \\ \hline 3\frac{5}{8} & 1\frac{1}{2} & 1\frac{5}{6} & \frac{5}{12} & 5\frac{19}{20} \end{array}$$

66, 70
77

Change these mixed numbers to fractions:

3. $3\frac{3}{4}$ $\frac{15}{4}$ $7\frac{1}{2}$ $\frac{15}{2}$ $5\frac{3}{8}$ $\frac{43}{8}$ $3\frac{5}{6}$ $\frac{23}{6}$ $2\frac{5}{12}$ $\frac{29}{12}$ 108

Multiply and check the work:

4. $\frac{3}{4} \times 16$ 12 $\frac{5}{8} \times 48$ 30 $\frac{2}{3} \times 36$ 24 87

5. $\frac{1}{2} \times 15$ $7\frac{1}{2}$ $\frac{3}{4} \times 15$ $11\frac{1}{4}$ $\frac{5}{6} \times 11$ $9\frac{1}{6}$ 89

6. $1\frac{1}{3} \times 21$ 28 $3\frac{1}{2} \times 19$ $66\frac{1}{2}$ $2\frac{1}{4} \times$ \$1.30 \$2.93 88, 91

7. $9 \times \frac{4}{5}$ $7\frac{1}{5}$ $8 \times \frac{5}{6}$ $6\frac{2}{3}$ $10 \times \frac{3}{5}$ 6 92

8. $4 \times 9\frac{1}{2}$ 38 $5 \times 2\frac{1}{4}$ $11\frac{1}{4}$ $8 \times 4\frac{5}{6}$ $38\frac{2}{3}$ 93

9. $\frac{1}{3} \times \frac{1}{2}$ $\frac{1}{6}$ $\frac{3}{4} \times \frac{3}{5}$ $\frac{9}{20}$ $\frac{1}{4} \times \frac{3}{4}$ $\frac{3}{16}$ 102

10. $8 \times \frac{7}{8}$ 7 $\frac{2}{3} \times \frac{9}{10}$ $\frac{3}{5}$ $\frac{3}{5} \times \frac{5}{12}$ $\frac{1}{4}$ 104

11. $\frac{9}{10} \times \frac{5}{6}$ $\frac{3}{4}$ $10 \times \frac{3}{8}$ $3\frac{3}{4}$ $\frac{7}{16} \times 12$ $5\frac{1}{4}$ 105

12. $\frac{2}{3} \times 2\frac{1}{4}$ $1\frac{1}{2}$ $\frac{3}{4} \times 1\frac{1}{3}$ 1 $\frac{5}{6} \times 2\frac{1}{2}$ $2\frac{1}{12}$ 110

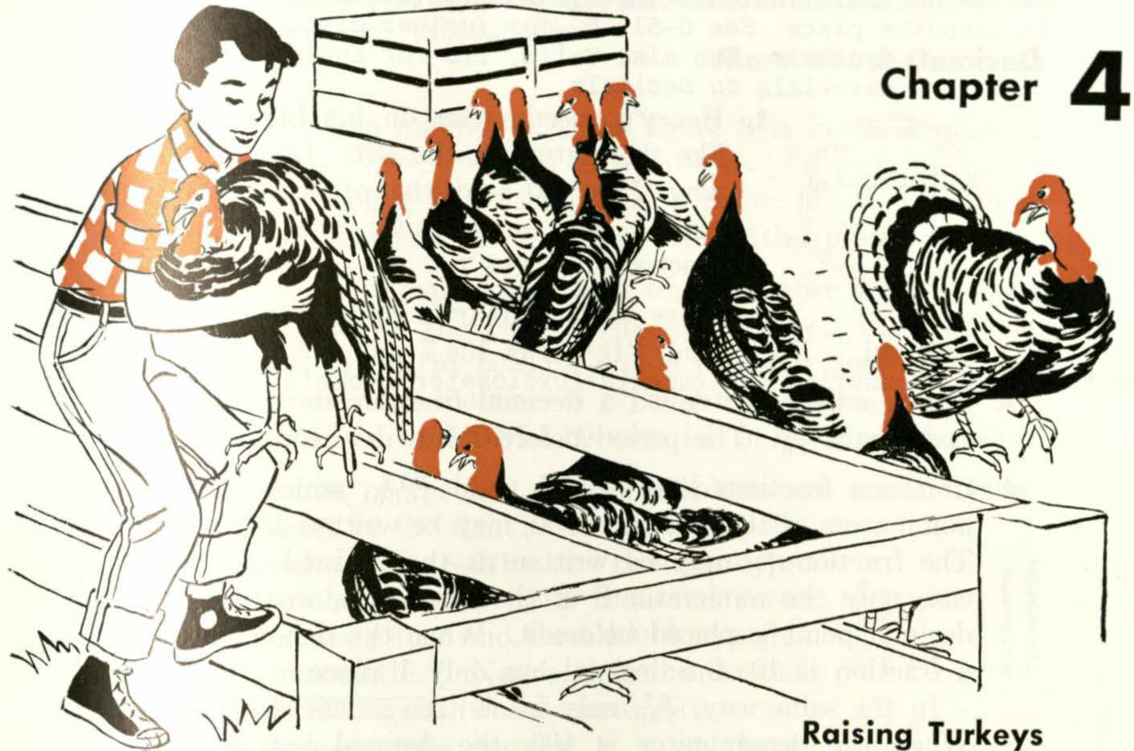
13. $3\frac{1}{8} \times \frac{4}{5}$ $2\frac{1}{2}$ $1\frac{1}{4} \times \frac{4}{5}$ 1 $7\frac{1}{2} \times \frac{2}{3}$ 5 110

14. $1\frac{1}{5} \times 6\frac{2}{3}$ 8 $1\frac{1}{8} \times 1\frac{1}{3}$ $1\frac{1}{2}$ $2\frac{1}{12} \times 1\frac{4}{5}$ $3\frac{3}{4}$ 110

Note errors on progress cards. After checking and returning papers, have volunteers explain examples at board so pupils may correct own errors. Be sure all difficulties are cleared up before assigning practice pages.

See G-51 for specific aims of Chapter 4.

Chapter 4



Raising Turkeys

Present problems involving project on raising turkeys.

1. Peter lives on a farm. This year he wanted to raise turkeys as his 4-H activity, so he bought 30 young turkeys at $.75 each. How much did he pay for them? $22.50

2. To raise the turkeys Peter spent $51.75 for feed and $48.40 for other supplies. How much did he spend all together? Include the cost of the turkeys found in ex. 1. $122.65

3. Peter raised all but two of the turkeys and sold them for $151.25. How much more did he get for the turkeys than he spent? See ex. 2. $28.60

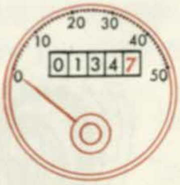
4. Next year Peter will not have to buy any supplies. If he buys 30 young turkeys then at $.75 each and pays $52.00 for feed, how much money in all will he spend? $74.50 If he sells the turkeys next year for $150.00, how much money will he make then? $75.50

5. Why will Peter make so much more money next year than he did this year? He will not have to pay for supplies.

Do problems as class activity, letting volunteers explain their solutions. Encourage pupils to make up other problems arising from own projects of similar nature, for class to solve.

Review decimal fractions through hundredths and extend through thousandths place. See G-51, 52 for further discussion of decimals. See also G-118, 119 for audio-visual materials on decimals.

Decimals



1. Henry's speedometer on his bicycle looks like the picture at the left. Do you know why 7 is red and the other figures are black? How many miles does this speedometer show? 134.7

2. Mary said, "Henry's speedometer shows 1347 mi." Betty said, "It shows 134.7 mi." Who is right? Betty

Try to display measuring instruments (cyclometer, odometer) for discussion.

3. The number .7 is called a decimal fraction, or a **decimal**, and means $\frac{7}{10}$. The period before 7 is a **decimal point.**

4. Common fractions like $\frac{8}{10}$, $\frac{37}{100}$, and $\frac{218}{1000}$, which have denominators of 10, 100, and 1000, may be written as decimals. The fraction $\frac{8}{10}$ may be written as the decimal .8; in this case only the numerator 8 of the fraction is written and a decimal point is placed before it. When the denominator of a fraction is 10, the decimal has only 1 place.

In the same way, $\frac{37}{100}$ may be written as the decimal .37. When the denominator is 100, the decimal has 2 places. The fraction $\frac{218}{1000}$ may be written .218.

When a fraction is written as a decimal, the decimal must have as many places to the right of the decimal point as there are zeros in the denominator of the fraction. Emphasize that position to right of decimal point tells the denominator.

5. When $\frac{5}{100}$ is written as a decimal, the decimal must have 2 places since the denominator of $\frac{5}{100}$ has 2 zeros. So $\frac{5}{100}$ is written .05; the zero is put before the 5 so that the decimal will have 2 places.

6. The fraction $\frac{375}{1000}$ is written as the decimal .375; $\frac{75}{1000}$ is written .075; while $\frac{7}{1000}$ is written .007. Each decimal has 3 places because the denominator 1000 has 3 zeros.

7. The number 6.57, which is made up of a whole number and a decimal, is called a **mixed decimal** and means $6\frac{57}{100}$.

Write each one as a decimal or a mixed decimal: Give further practice.

8. $\frac{3}{10}$ .3 $\frac{29}{100}$ .29 $\frac{416}{1000}$ .416 $\frac{9}{100}$ .09 $7\frac{8}{10}$ 7.8 $\frac{27}{1000}$ .027 $3\frac{19}{100}$ 3.19

Emphasize that decimal fractions are another way of writing common fractions, whose denominators are 10 or powers of 10. Refer to them as decimal fractions, not just decimals.

Extend practice of reading decimal fractions and mixed decimals through thousandths.

More about Decimals

1. In the whole number 723, the figure 3 is in **ones** place, 2 is in **tens** place, and 7 is in **hundreds** place. In the same way, each place in a decimal has a name; in .36, the 3 is in **tenths** place and the 6 is in **hundredths** place.

2. To read a decimal, read it as a whole number and then give it the name of the place of its **last figure.** For example, .8 is read 8 **tenths** because 8 is in **tenths** place; .36 is read 36 **hundredths** because 6 is in **hundredths** place; and .04 is read 4 **hundredths** because 4 is in **hundredths** place.

3. The names of the first 3 decimal places are shown below: The places to the right of the decimal point are **tenths, hundredths,** and **thousandths.** The number is read "two thousand seven hundred sixty-four and three hundred eighteen thousandths." Notice that the decimal Stress point is read **and.** The decimal .318 is read 318 **thousandths** because 8 is in **thousandths** place.

Thousands	Hundreds	Tens	Ones		Tenths	Hundredths	Thousandths
2	7	6	4	.	3	1	8

4. In the business world a number such as 408.62 is often read **four-o-eight-point-six-two.** Zero is read like the letter o and the decimal point is read **point.**

5. Sometimes .7 is written 0.7. When there is no figure at the left of the decimal point, a zero is often written there to make sure that the decimal point will not be overlooked.

Read each number in two ways: See G-53.

6. .6 .35 .293 .09 .037 .007 25.04 4.033

7. .2 0.8 0.61 .13 0.01 0.10 4.328 7.005

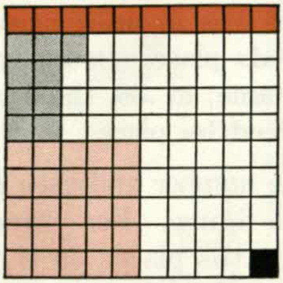
8. .9 0.3 0.39 .04 0.05 0.17 6.043 9.019

9. Write each number in ex. 6–8 as a common fraction or a See G-53. mixed number. If the name of the decimal is hundredths, the denominator of the fraction will be 100; if the name of the decimal is thousandths, the denominator will be 1000.

Follow development as given on page. Have pupils make own place-value chart (as in ex. 3) to use to read and write other decimal fractions. As pupils read decimals, be sure they say "tenths" or "hundredths," not ten or hundred, and so on.

Extend understanding of relationship which exists between common and decimal fractions.

Studying Decimals



1. How many small squares are there in this large square? 100 What part of the large square is red? .10 What part is pink? 25 gray? 09 black? 01 What part of the large square is not colored? Write your answers, using decimals. .55

Have pupils use common fractions also.

2. How many rows of small squares are there in the large square? 10 One row is what part of the large square? .1 Write this decimal.

3. How many small squares are there in the large square? 100 How many small squares are there in 1 row? 10 One row is what part of the large square? .10 Write your answer as a decimal which has two decimal places.

4. Can you say that .1 = .10? Tell how you know whether these two decimals are equal or not. Ask also if $\frac{1}{10} = \frac{10}{100}$.

5. Look at the large square above and tell which decimal is larger: .1 or .01; .3 or .03; .08 or .8. .1, .3, .8

6. You are using decimals when you write dollars and cents. For example, \$6.34 means \$$6\frac{34}{100}$. Since there are 100 cents in a dollar, 1 cent is $\frac{1}{100}$ of a dollar and 34 cents is $\frac{34}{100}$ of a dollar. So 34 cents is written as the decimal .34.

Point out how clumsy it is to write \$6.34 as \$$6\frac{34}{100}$.

7. When measurements are made, decimals are often used to state the results as shown below:

.6 ft. is another way of writing $\frac{6}{10}$ ft.
.53 lb. is another way of writing $\frac{53}{100}$ lb.
4.3 mi. is another way of writing $4\frac{3}{10}$ mi.

Read these numbers: See G-54 for ex. 9–10.

Two and nine tenths feet — Two hundredths second — Fifteen and seventeen thousandths inches

8. 2.9 ft. 4.58 in. .02 sec. 69.8 mi. 15.017 in.

Four and fifty-eight hundredths inches — Sixty-nine and eight tenths miles

9. .78 lb. 12.7 hr. 9.6 gal. .059 in. 8013.2 mi.

10. 0.7 mi. .125 lb. .18 sec. 0.75 lb. 10.875 in.

Provide pupils with whole square, strips of tens, and single squares (use graph paper) to use in discussing ex. 1–5.
Emphasize that $1 = \frac{10}{10}$ (1.0) $= \frac{100}{100}$ (1.00) and that $\frac{1}{10}$ (.1) $= \frac{10}{100}$ (.10).
Give further practice in showing other common and decimal fractions.

Review and discuss place value in our system of writing numbers.

More about Place Value

1. Study the numbers below. In A the 7 stands for \$.07. If you move the 7 one place to the left, you get B, in which the 7 stands for \$.70. \$.70 is 10 times \$.07. This shows that when you move the 7 one place to the left, its value becomes 10 times as great.

A. In \$3000.07 the 7 stands for \$ .07
B. In \$3000.70 the 7 stands for \$ .70
C. In \$3007.00 the 7 stands for \$ 7.00
D. In \$3070.00 the 7 stands for \$70.00

Now look at B, where the 7 stands for \$.70. If you move this 7 one place to the left, you get C. But in C the 7 stands for \$7.00. \$7.00 is 10 times \$.70. Again you see that the value of the 7 becomes 10 times as great by moving it one place to the left.

2. Is the value of 7 in D 10 times its value in C? Why?

Lead pupils to discover the following.

If any figure of a number is moved one place to the left, its value is multiplied by 10.

Tell what the figure 5 stands for in each number:

Thousands Hundreds
3. 2452.7 Tens 5862.4 8569.2 4765.3 Ones 9743.5 Tenths
Hundreds Hundredths Thousands
4. 3586.2 2467.5 Tenths 186.35 5367.1 6475.3 Ones

5. The number 6 stands for 6 ones. If you wish to move the 6 one place to the left so that it stands for 6 tens or 60, you have to write a zero in ones place. The zero holds the ones place and keeps the 6 in tens place. So a zero in a number is sometimes called a **place holder.**

6. Study these Roman numerals: V, VI, VII. The number V stands for 5. If you move this V one place to the left, as in VI, does its value become 10 times as great as before? No
Is the value of V in VII 10 times as great as it is in VI? No
Does the Roman system of numbers have place value? No

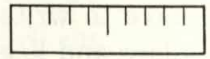
Ex. 1 may also be used to lead pupils to see that if figure is moved one place to right, it has $\frac{1}{10}$ its value. Also, pupils should see that value of places in number system increases as you go from right to left (by multiplier of 10), decreases from left to right (divisor of 10).

Introduce practical use of decimals. Informally determine pupils' knowledge of addition and subtraction of decimals for later teaching or reteaching.

How Deep Is the Snow?

1. In the winter when there is a fall of snow, the Weather Man reports the amount of snow in inches. For example, in New York City the day after the blizzard of March 12, 1888 began, the Weather Man reported that 16.5 in. of snow fell during the first 24 hours. Now weather reports are given in the newspapers, on the radio, and on television.

2. The Weather Man gives the amount of the snow to **tenths** of an inch instead of using **quarters** or **eighths** of an inch. When measurements are made to **tenths** of an inch, the inch is divided into 10 equal parts, as shown at the right. The ruler you use in school shows **quarters** and **eighths** of an inch. Is $\frac{1}{8}$ of an inch a little longer or a little shorter than $\frac{1}{10}$ of an inch? Longer Put your ruler under the picture of the inch, shown above, to see how $\frac{1}{8}$ in. on your ruler compares with $\frac{1}{10}$ in.



3. One day 2.7 in. of snow fell. The next day 3.2 in. more fell. How many inches of snow fell on both days? 5.9

Discuss problems on these pages with pupils. If possible, plan class visit to Weather Bureau in your city to see instruments that measure snowfall and rainfall.

4. The amount of snow is measured by means of a rod, marked in inches and tenths of an inch, which is pushed vertically into the snow. When the wind causes the snow to drift so that it is deeper in one place than another, the snow is measured at several different places and the average of these measurements is found. This average amount of snow, which is figured to tenths of an inch, is the one reported by the Weather Man.

5. A very big snowstorm occurred in New York City on Dec. 26, 1947. When the storm was over, a total of 25.8 in. of snow had fallen. This was 4.9 in. more than the total amount of snow that fell in New York City during the blizzard of 1888. How much snow fell in New York City during the blizzard of 1888? 20.9 in.

6. The average amount of snow that falls in Boston during the winter is 42.3 in., and the average amount that falls in Salt Lake City is 55.1 in. How much more snow usually falls in Salt Lake City than in Boston during the winter? 12.8 in.

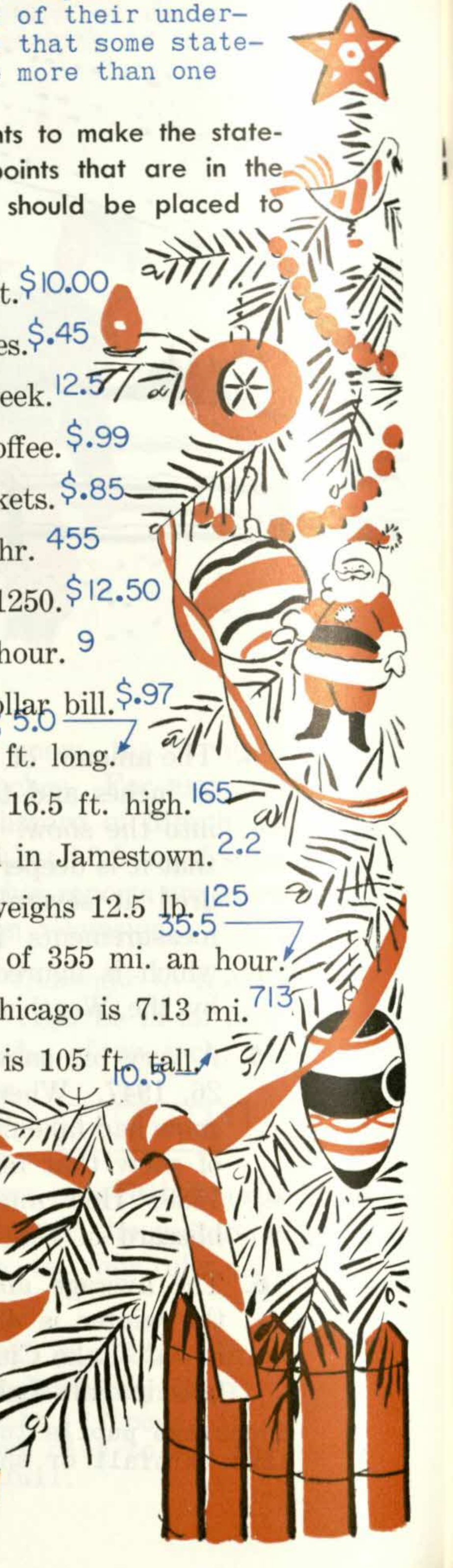
Encourage pupils to bring in and read weather reports which list rainfall or snowfall in different areas of United States.

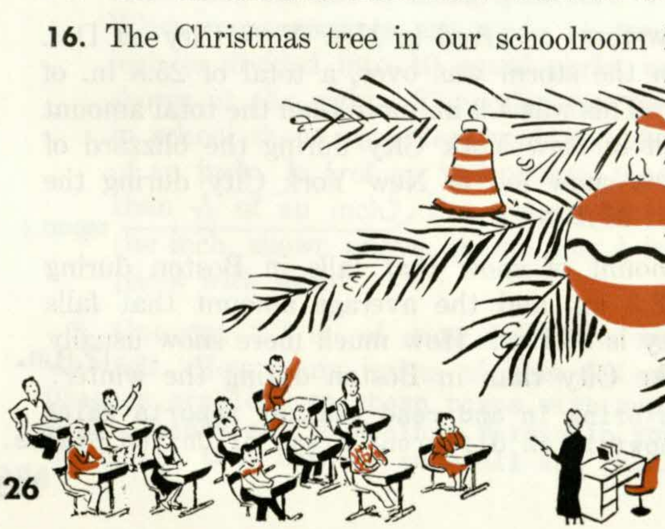
Test understandings in decimal fractions. Pupils' corrections of these examples will show extent of their understanding. Note that some statements may have more than one answer.

Is There Anything Wrong?

Some of the numbers below need decimal points to make the statements sensible; other numbers have decimal points that are in the wrong places. Tell where the decimal points should be placed to make the statements sensible:

1. Mrs. Johnson paid $1000 for a new hat. $10.00
2. Mary spent $45 for 1 doz. large oranges. $.45
3. After school George works 125 hr. a week. 12.5
4. Mr. King paid $9.90 for a pound of coffee. $.99
5. Father paid $.085 apiece for movie tickets. $.85
6. A fast airplane traveled 45.5 mi. in 1 hr. 455
7. Jack sold his old bicycle to Bob for $1250. $12.50
8. Patty can ride her bicycle 0.9 mi. an hour. 9
9. Ann received $9.70 change from a 5-dollar bill. $.97
10. Miss Hill's desk is 35 ft. wide and 50 ft. long. 3.5; 5.0
11. An apartment house with 10 stories is 16.5 ft. high. 165
12. One day last winter 22 ft. of snow fell in Jamestown. 2.2
13. Peter's big brother is 16 yr. old and weighs 12.5 lb. 125
14. Miss Brown drives her car an average of 355 mi. an hour. 35.5
15. The air distance from New York to Chicago is 7.13 mi. 713
16. The Christmas tree in our schoolroom is 105 ft. tall. 10.5





Present second set of improvement tests in subtraction of whole numbers.

Improving by Practice

Subtraction Test 2a.

Time: 4 min.

1.	$56.98	$97.95	$70.03	$58.64	$65.42	
	36.46	95.39	38.35	43.68	9.65	
	$20.52	$2.56	$31.68	$14.96	$55.77	
2.	$38.17	$93.25	$53.68	$60.00	$32.38	
	34.66	46.57	9.28	52.65	28.99	
	$ 3.51	$46.68	$44.40	$ 7.35	$ 3.39	
3.	$91.82	$48.50	$77.84	$55.62	$50.00	
	58.98	28.66	7.97	35.83	25.17	⑮
	$32.84	$19.84	$69.87	$19.79	$24.83	

Subtraction Test 2b.

Time: 4 min.

4.	$55.46	$92.21	$76.92	$67.85	$30.00	
	14.48	2.34	74.24	31.35	13.53	
	$40.98	$89.87	$ 2.68	$36.50	$16.47	
5.	$80.03	$89.26	$52.12	$60.56	$29.61	
	29.87	81.71	37.23	4.46	19.79	
	$50.16	$ 7.55	$14.89	$56.10	$ 9.82	
6.	$66.24	$40.00	$74.45	$88.40	$97.74	
	6.56	14.79	25.89	48.67	69.05	⑮
	$59.68	$25.21	$48.56	$39.73	$28.69	

Subtraction Test 2c.

Time: 4 min.

7.	$87.48	$83.24	$33.72	$80.00	$77.46	
	75.14	5.89	31.46	36.75	62.47	
	$12.34	$77.35	$ 2.26	$43.25	$14.99	
8.	$40.00	$54.24	$65.85	$69.49	$32.62	
	25.16	49.68	35.96	28.72	2.83	
	$14.84	$ 4.56	$29.89	$40.77	$29.79	
9.	$89.63	$92.78	$70.06	$74.75	$68.30	
	79.75	59.48	3.49	28.89	48.84	⑮
	$ 9.88	$33.30	$66.57	$45.86	$19.46	

To the Teacher. Have each pupil compare the graph for his scores on Subtraction Tests 2a, 2b, and 2c above with the graph he made of his scores on Subtraction Tests 1a, 1b, and 1c. In this way he can see whether he is improving in subtraction.

Tests are to be given, scored, recorded in same way as addition tests (see pages 54-58). Correct papers and note causes of errors: regrouping, facts, zero difficulties, carelessness. Plan for remedial activities as needed.

Teach how to add decimals with like names. Use materials and place pocket chart to show exchange of 10 tenths for 1 whole in ex. 1. To explain placement of decimal point, refer to examples involving rainfall.

Adding Decimals

1. **Problem** Bob has a new speedometer on his bicycle that tells how far he rides. The speedometer gives the distances to **tenths** of a mile. On Thursday he rode 4.8 mi., on Friday he rode 8.3 mi., and on Saturday he rode 14.8 mi. How many miles in all did he ride in the three days? 27.9

Explanation When you add these distances be sure to keep the decimal points in a line under one another. Place a decimal point in the answer under the other decimal points. Bob rode 27.9 mi. in three days. To check the work, add down.

$$\begin{array}{r} 4.8 \\ 8.3 \\ 14.8 \\ \hline 27.9 \end{array}$$

2. The amount of rainfall is reported by the Weather Bureau to **hundredths** of an inch. One year the amounts of rainfall in New York City during July, August, and September were 8.29 in., 6.26 in., and 5.38 in. What was the total rainfall that year during these three months? 19.93 in.

3. Helen read that the amounts of annual rainfall in her city during the last five years were: 14.26 in., 11.45 in., 16.31 in., 9.16 in., 10.47 in. What was the total rainfall in this city during the five-year period? 61.65 in.

Add up. Check your work by adding down:

4.	.72	23.7	1.65	15.9	3.125	1.723
	2.49	11.4	4.93	24.9	1.069	6.192
	1.15	9.8	7.08	10.7	2.198	4.289
	4.36	44.9	13.66	51.5	6.392	12.204
5.	3.42	26.4	4.34	5.46	2.363	1.625
	.55	17.1	1.38	5.83	5.628	4.250
	.27	8.9	6.66	7.47	4.595	3.875
	3.48	5.1	7.25	3.72	5.313	2.666
	7.72	57.5	19.63	22.48	17.899	12.416
6.	38.8	9.81	3.23	6.35	4.858	8.914
	47.1	7.39	5.40	2.72	.613	.857
	96.6	.75	2.74	3.81	.794	7.262
	87.9	8.16	5.39	.91	1.105	.936
	40.8	7.76	7.23	7.44	4.573	2.066
	311.2	33.87	23.99	21.23	11.943	20.035

Demonstrate few more examples like ex. 1. Lead pupils to see that decimals are added in the same way as whole numbers.

Adding Decimals

1. **Problem** Judy bought a sweater for \$5, a scarf for \$1.47, a pair of shoes for \$7, and a purse for \$2.34. How much did she pay for all of these things? \$15.81

Explanation You can write the amounts in this problem as at A and add them. It may be easier, however, for you to add these amounts if you write a decimal point and two zeros after \$5 and \$7 as at B. Judy paid \$15.81 in all. When you find an addition example in decimals where the numbers do not all have the same number of decimal places, you must be careful to keep the decimal points under one another. When you add decimals that stand for measurements they should all be to tenths, or all to hundredths, or all to thousandths, and so on.

A	B
\$5.	\$5.00
1.47	1.47
7.	7.00
2.34	2.34
\$15.81	\$15.81

2. Peter paid \$6.45 for a pair of skis, \$1.89 for a ski pole, \$2.50 for a ski cap, and \$8 for ski pants. How much did he pay for all these things? \$18.84

Remind pupils to copy carefully and keep columns straight.

Copy **in columns and add:**

3. 7 + 4.77 + 3.25 + 2.5 + 1.12 + 4 + .37 23.01
4. 7.36 + 4.25 + 12.84 + 3.47 + 10.62 + 2.08 40.62
5. 14 + 34.1 + 15.4 + 6 + 13.7 + 12.6 + 1 96.8
6. 4.625 + 18.5 + 14.4 + .125 + 7.25 + 20.75 65.650
7. 9.5 + 7 + .375 + 5.25 + 17.5 + 4.75 + 1.875 46.250
8. 6.75 + 5.67 + 8 + 14.5 + 8.333 + 1.25 + 4.375 48.878
9. 7.5 + 2.375 + 4.166 + 9.8 + 1.75 + 5.125 + 2 32.716
10. 8.4 + 14.75 + 3.375 + 11.5 + 21.5 + 12.75 + .5 72.775
11. 6.625 + 3.75 + 2.875 + 7.25 + 4.333 + 10.5 35.333
12. 8.666 + 4.125 + 9.5 + 3.25 + 1.167 + 15.5 + 3.75 45.958

Be sure pupils understand that in adding whole numbers and decimals, decimal point should be written to right of each whole number.

First review subtraction without regrouping. Then do some simple examples involving regrouping, using place pocket chart and materials, to show exchange of 1 whole for 10 tenths. Then do ex. 1-3 with pupils.

Subtracting Decimals

1. Problem When the Hall family started on a vacation trip, the speedometer on the car read 6287.6 mi. At the end of their trip it read 9092.4 mi. How many miles did the car go on that trip? 2804.8

Explanation When you subtract these decimals be sure to keep the decimal points in a line under one another as you do in addition. Place a decimal point in the answer under the other decimal points. To check, add 2804.8 and 6287.6 to see if the sum is 9092.4.

$$\begin{array}{r} 9092.4 \\ \underline{6287.6} \\ 2804.8 \end{array}$$

2. It is 18.4 mi. from Westfield to Green Bay and 13.6 mi. from Westfield to Johnstown. How much farther is it to Green Bay than to Johnstown? 4.8 mi.

3. Jim is making a ship model that he bought for \$8.15. He had saved \$12.75 in order to buy one. How much money has Jim left now? \$4.60

Have pupils explain work in ex. 4-8; in particular, regrouping from tenths and hundredths places.

Subtract and check your work:

4.	78.4	51.3	2.467	9.750	$2869.45
	59.3	47.5	.375	6.125	984.68
	19.1	3.8	2.092	3.625	$1884.77
5.	15.4	92.9	6.935	5.125	$6000.00
	9.8	58.3	4.659	1.750	1572.43
	5.6	34.6	2.276	3.375	$4427.57
6.	82.2	3.34	6.333	7.542	$1200.50
	45.7	2.47	2.667	2.643	489.56
	36.5	.87	3.666	4.899	$ 710.94
7.	7.66	7.35	5.875	77.62	$6151.55
	3.69	6.97	3.750	26.53	4121.69
	3.97	.38	2.125	51.09	$2029.86
8.	1.18	62.0	82.11	69.11	$8000.00
	.63	43.8	37.99	11.22	7639.74
	.55	18.2	44.12	57.89	$ 360.26

Teach subtraction of ragged decimals. Review work on page 130 if necessary.

Subtracting Decimals

1. Bob wants to buy a basketball for $5. He has saved $2.65. How much more money must he save in order to buy it? $2.35

▶ You could write the numbers as at A, but it is easier if you write a decimal point and two zeros after $5 as shown at B.

A	B
$5.	$5.00
2.65	2.65

2. The pupils in the sixth grade are earning money in order to give $50 to the Red Cross. They had a White Elephant Fair and earned $27.82. How much more money must they earn to have $50? $22.18

3. The North School received a gift of $300 to be used to buy new books for the school library. The books which have been purchased cost a total of $193.47. How much money is left to spend for new books? $106.53

Subtract and check your work: Have pupils explain exchange involved

4.	90.0	8.00	20.00	600.00	7000.00
	4.7	1.93	7.48	213.64	3628.52
	85.3	6.07	12.52	386.36	3371.48

Copy in columns and subtract: Check pupils as they work to note any difficulties in annexing zeros, regrouping, and so on.

5.	19.6 – 14.7 4.9	1.82 – .44 1.38	$454 – $274.50 $179.50
6.	52.8 – 44.2 8.6	5.13 – 2.5 2.63	$500 – $375.39 $124.61
7.	79.0 – 25.5 53.5	6.54 – .58 5.96	$640 – $494.26 $145.74
8.	2.75 – .625 2.125	64.3 – .25 64.05	$700 – $559.25 $140.75
9.	18.6 – 5.74 12.86	80.0 – .67 79.33	$394 – $305.40 $88.60
10.	55.4 – 9.83 45.57	8.75 – 5.9 2.85	$428 – $182.87 $245.13
11.	2.08 – .435 1.645	30.0 – .21 29.79	$960 – $332.36 $627.64
12.	426 – 68.7 357.3	.833 – .75 .083	$537 – $158.69 $378.31
13.	3.25 – .875 2.375	2.15 – .25 1.90	$447 – $267.17 $179.83
14.	16.5 – 6.67 9.83	26.0 – .86 25.14	$329 – $139.75 $189.25

Discuss ex. 1–3 carefully with pupils. Do other money examples if needed. Emphasize that thousandths are subtracted from thousandths, hundredths from hundredths, and so on. Have brighter pupils make up problems, using numbers in ex. 13–14.

Present illustrations of some uses of decimal fractions in everyday life: see Guide for discussion.

Using Decimals

1. The scales the school nurse uses to weigh the pupils measure weights to tenths of a pound. George weighs 83.5 lb. and Bill weighs 80.9 lb. Find the difference in their weights. 2.6 lb.

2. One year in Georgetown the rainfall amounted to 4.96 in. in June, 2.53 in. in July, 2.36 in. in August, and 1.80 in. in September. How many inches of rain fell in Georgetown in these 4 mo.? 11.65

3. In Pine Plains from June through September 13.14 in. of rain fell. How many more inches of rain fell in Pine Plains than in Georgetown from June through September? 1.49 See ex. 2.

4. A rectangular city lot is 145.8 ft. long and 68.5 ft. wide. How many feet are there in the perimeter of this lot? 428.6

5. The timetable at the right shows
how many miles each station is
from New York. How many miles
is it from New York to Philadel-
85.9 phia? from Philadelphia to Co-
544.3 lumbus? from Columbus to St.
420.4 Louis? from Philadelphia to St. Louis? 964.7

Miles	Station	Time
0.0	New York	**5:45**
85.9	Philadelphia	**7:14**
630.2	Columbus	6:13
1050.6	St. Louis	**1:00**

6. In the last three days Betty rode her bicycle 6.4 mi., 4.7 mi., and 6.2 mi. How many miles did she ride in all? 17.3

7. It is 48.5 mi. from Jackson to Lake Clear by the old road. The new road between these two towns is 44.8 mi. long. How many miles shorter is the new road than the old one? 3.7

8. Jim looked at the speedometer on his father's car as they started on a trip. It showed 4897.4 mi. Jim figured how many miles they would have to ride to have the speedometer show 5000.0 mi. Can you find out too? 102.6

Have pupils note various ways decimals are used: ex. 1, weight; ex. 2-3, rainfall; ex. 4, linear measurement; ex. 5-8, mileage. Urge pupils to bring to class descriptions of other ways in which decimal fractions are used.

Present larger magic squares in which 12 sums must be alike.

Magic Squares

1. Find the sum of the first row of numbers: 17 + 24 + 1 + 8 + 15. Next find the sum of the first column of numbers: 17 + 23 + 4 + 10 + 11. Then find the sum of one diagonal: 17 + 5 + 13 + 21 + 9. Find the sum of each of the other rows, columns, and the other diagonal. Are the 12 sums all the same? If so, this is a **magic square.** Yes, all sums equal 65.

17	24	1	8	15
23	5	7	14	16
4	6	13	20	22
10	12	19	21	3
11	18	25	2	9

Are the two squares below magic squares? Why? Yes All sums in each are equal.

Sums: 65

2.

4	23	17	11	10
12	6	5	24	18
25	19	13	7	1
8	2	21	20	14
16	15	9	3	22

60

3.

10	17	24	1	8
9	11	18	20	2
3	5	12	19	21
22	4	6	13	15
16	23	0	7	14

To find missing numbers in ex. 4 add first row of numbers. From this, subtract sum of 4 numbers in second row. Result is missing number. Follow similar procedure for others.

Put the missing numbers in these squares to make them magic squares. First find what the sum should be. Test the final squares:

Sums: 260

4.

53	42	56	45	64
61	50	44	58	47
49	63	52	41	55
57	46	60	54	43
40	59	48	62	51

65

5.

23	1	2	20	19
22	16	9	14	4
5	11	13	15	21
8	12	17	10	18
7	25	24	6	3

First review meaning of magic square: one in which each horizontal row, vertical column, and diagonal row of numbers all have same sum. Have pupils make up another magic square for partners to test.

Present review of skills of adding, subtracting, and multiplying common fractions and mixed numbers.

Fraction Review

Write in columns and find the answers:

1. $5\frac{3}{8} + 2\frac{3}{4} + 1\frac{1}{8}$ $9\frac{1}{4}$ $9\frac{1}{6} - 5\frac{1}{2}$ $3\frac{2}{3}$ $3\frac{5}{6} + 1\frac{5}{6}$ $5\frac{2}{3}$ $5\frac{3}{4} + 3\frac{1}{12}$ $8\frac{5}{6}$

2. $1\frac{3}{5} + 4\frac{4}{5} + 2\frac{3}{5}$ 9 $4\frac{7}{8} + 2\frac{3}{8}$ $7\frac{1}{4}$ $14 - 2\frac{1}{4}$ $11\frac{3}{4}$ $9\frac{1}{2} - 2\frac{11}{16}$ $6\frac{13}{16}$

3. $2\frac{2}{3} + 3\frac{1}{4} + 2\frac{5}{6}$ $8\frac{3}{4}$ $8\frac{4}{5} - 6\frac{1}{2}$ $2\frac{3}{10}$ $1\frac{3}{4} + 1\frac{2}{3}$ $3\frac{5}{12}$ $7\frac{4}{5} - 4\frac{3}{10}$ $3\frac{1}{2}$

4. Multiply each number by $\frac{3}{4}$: 5, $3\frac{3}{4}$ 10, $7\frac{1}{2}$ $\frac{2}{3}$, $\frac{1}{2}$ $1\frac{1}{3}$, 1 $6\frac{2}{3}$. 5

5. Change to lowest terms: $\frac{6}{8}$, $\frac{3}{4}$ $\frac{8}{10}$, $\frac{4}{5}$ $\frac{10}{15}$, $\frac{2}{3}$ $\frac{9}{21}$, $\frac{3}{7}$ $\frac{14}{28}$, $\frac{1}{2}$ $\frac{27}{45}$, $\frac{3}{5}$ $\frac{15}{60}$. $\frac{1}{4}$

6. Change to mixed numbers: $\frac{10}{3}$, $3\frac{1}{3}$ $\frac{17}{4}$, $4\frac{1}{4}$ $\frac{25}{2}$, $12\frac{1}{2}$ $\frac{12}{8}$, $1\frac{1}{2}$ $\frac{21}{6}$, $3\frac{1}{2}$ $\frac{15}{10}$. $1\frac{1}{2}$

7. Change to fractions: $4\frac{1}{2}$, $\frac{9}{2}$ $6\frac{1}{4}$, $\frac{25}{4}$ $2\frac{3}{8}$, $\frac{19}{8}$ $8\frac{3}{4}$, $\frac{35}{4}$ $10\frac{1}{3}$, $\frac{31}{3}$ $12\frac{1}{2}$, $\frac{25}{2}$ $20\frac{3}{5}$. $\frac{103}{5}$

Add. Check your work by going over it:

8.	$2\frac{3}{8}$	$2\frac{2}{3}$	$3\frac{3}{4}$	$1\frac{1}{2}$	$2\frac{1}{12}$	$3\frac{4}{5}$	$4\frac{5}{16}$
	$1\frac{7}{8}$	$4\frac{1}{6}$	$2\frac{1}{2}$	$4\frac{5}{6}$	$2\frac{7}{12}$	$3\frac{1}{2}$	$1\frac{3}{4}$
	$3\frac{5}{8}$	$2\frac{1}{2}$	$1\frac{5}{6}$	$3\frac{7}{8}$	$2\frac{7}{12}$	$2\frac{7}{10}$	$3\frac{5}{8}$
	$7\frac{7}{8}$	$9\frac{1}{3}$	$8\frac{1}{12}$	$10\frac{5}{24}$	$7\frac{1}{4}$	10	$9\frac{11}{16}$

Subtract. Check your work by going over it:

9.	$8\frac{1}{6}$	$4\frac{3}{4}$	$9\frac{1}{2}$	$5\frac{3}{4}$	$7\frac{1}{4}$	$8\frac{7}{16}$	$6\frac{3}{4}$
	$5\frac{3}{4}$	$1\frac{2}{3}$	$4\frac{7}{8}$	$4\frac{5}{6}$	$5\frac{11}{12}$	$3\frac{1}{16}$	$3\frac{7}{10}$
	$2\frac{5}{12}$	$3\frac{1}{12}$	$4\frac{5}{8}$	$\frac{11}{12}$	$1\frac{1}{3}$	$5\frac{3}{8}$	$3\frac{1}{20}$
10.	$9\frac{7}{8}$	$5\frac{5}{6}$	$7\frac{5}{8}$	$4\frac{1}{3}$	$9\frac{3}{8}$	$6\frac{3}{10}$	$5\frac{7}{12}$
	$6\frac{3}{8}$	$3\frac{1}{3}$	$2\frac{1}{4}$	$3\frac{1}{2}$	$3\frac{13}{16}$	$2\frac{4}{5}$	$1\frac{3}{4}$
	$3\frac{1}{2}$	$2\frac{1}{2}$	$5\frac{3}{8}$	$\frac{5}{6}$	$5\frac{9}{16}$	$3\frac{1}{2}$	$3\frac{5}{6}$

Multiply. Check your work by going over it:

11. $\frac{2}{3} \times \frac{2}{3}$ $\frac{4}{9}$ $1\frac{1}{8} \times \frac{2}{3}$ $\frac{3}{4}$ $\frac{2}{3} \times 1\frac{1}{2}$ 1 $2\frac{1}{2} \times 2\frac{2}{5}$ 6

12. $5 \times \frac{3}{8}$ $1\frac{7}{8}$ $12 \times \frac{3}{4}$ 9 $\frac{5}{8} \times 3\frac{1}{5}$ 2 $12 \times 3\frac{1}{2}$ 42

13. $\frac{5}{8} \times 4$ $2\frac{1}{2}$ $3\frac{1}{3} \times \frac{3}{4}$ $2\frac{1}{2}$ $\frac{3}{4} \times 1\frac{2}{3}$ $1\frac{1}{4}$ $1\frac{1}{4} \times 1\frac{1}{4}$ $1\frac{9}{16}$

14. $\frac{1}{6} \times \frac{3}{4}$ $\frac{1}{8}$ $10 \times \frac{5}{6}$ $8\frac{1}{3}$ $9 \times \frac{3}{10}$ $2\frac{7}{10}$ $\frac{3}{10} \times 6\frac{2}{3}$ 2

15. $\frac{4}{5} \times \frac{5}{6}$ $\frac{2}{3}$ $2\frac{2}{5} \times \frac{5}{6}$ 2 $\frac{5}{6} \times 18$ 15 $1\frac{1}{2} \times 3\frac{1}{2}$ $5\frac{1}{4}$

Note that work is carefully graded and examples increase in difficulty from left to right. You can thus judge at what point pupils need further review or reteaching (use developmental material found on pages related to pupils' difficulties).

Changing Decimals to Fractions

1. **Problem** Peter measured the distance to his school, using the speedometer on his bicycle. He found the distance to be .6 mi. Show that this is the same as $\frac{3}{5}$ mi.

Explanation You know that $.6 = \frac{6}{10}$. If you change $\frac{6}{10}$ to lowest terms, you get $\frac{3}{5}$. So $.6 = \frac{3}{5}$.

2. Bill has $.75. He says that he has 3 fourths of a dollar. Show that Bill is right. $\$\frac{75}{100} = \$\frac{3}{4}$

Change these decimals to fractions: Stress changing to lowest terms.

3. .25 $\frac{1}{4}$ .50 $\frac{1}{2}$ .30 $\frac{3}{10}$ .65 $\frac{13}{20}$ .32 $\frac{8}{25}$ .60 $\frac{3}{5}$ .85 $\frac{17}{20}$

4. .90 $\frac{9}{10}$ .24 $\frac{6}{25}$ .52 $\frac{13}{25}$ .44 $\frac{11}{25}$ .15 $\frac{3}{20}$ .76 $\frac{19}{25}$ .28 $\frac{7}{25}$

5. Remember these decimals and their fractional values:

Emphasize.

$$.25 = \frac{1}{4} \qquad .50 = \frac{1}{2} \qquad .75 = \frac{3}{4}$$

6. **Problem** Change .375 to a fraction.

Explanation You know that $.375 = \frac{375}{1000}$. Dividing both terms of $\frac{375}{1000}$ by 5, you get $\frac{75}{200}$. Dividing both terms of $\frac{75}{200}$ by 5, you get $\frac{15}{40}$. You can then change $\frac{15}{40}$ to $\frac{3}{8}$. So $.375 = \frac{3}{8}$. $\frac{375}{1000}$ was changed to lowest terms in three steps as follows:

$$\frac{375}{1000} = \frac{75}{200} = \frac{15}{40} = \frac{3}{8}$$

7. Try to change $\frac{375}{1000}$ to $\frac{3}{8}$ in less than three steps.

Emphasize that any decimal fraction can be written as common fraction.

Change these decimals to fractions:

8. .625 $\frac{5}{8}$ .250 $\frac{1}{4}$ .650 $\frac{13}{20}$ .125 $\frac{1}{8}$ .750 $\frac{3}{4}$ .175 $\frac{7}{40}$

9. .425 $\frac{17}{40}$ .875 $\frac{7}{8}$ .325 $\frac{13}{40}$ .725 $\frac{29}{40}$ .275 $\frac{11}{40}$ .450 $\frac{9}{20}$

More Practice. See ㉓ on page 318.

Review first that number of "places" to right of decimal point tells denominator of the fraction and that the "numbers" to right of decimal point make up the numerator. Review also meaning of lowest terms (see page 60).

Teach meaning of tenth of cent and ways of writing it.

Writing Tenths of a Cent

1. Problem At a sale Jean paid \$3.41 for a piece of cloth 10 yd. long. How much per yard did the cloth cost? $\$.34\frac{1}{10}$

$$\begin{array}{r} \$.34\frac{1}{10} \\ 10\overline{)\$3.41} \\ 3\,0 \\ \hline 41 \\ 40 \\ \hline 1 \end{array}$$

Explanation You see that the cloth cost $\$.34\frac{1}{10}$ per yard. $\$.34\frac{1}{10}$ may also be written as $34\frac{1}{10}$¢. The $\frac{1}{10}$ in $34\frac{1}{10}$¢ means $\frac{1}{10}$ of a cent. Emphasize fact that it is $\frac{1}{10}$ of a "cent," not just $\frac{1}{10}$.

2. Problem Dick says that another way to write $\$.34\frac{1}{10}$ is \$.341. He says that the 1 in \$.341 equals $\frac{1}{10}$ of a cent. You can see below how Dick shows that this is so.

Explanation The 1 in \$.341 means \$.001, which equals $\frac{1}{1000}$ of a dollar. $\frac{1}{10}$ of a cent also equals $\frac{1}{1000}$ of a dollar because a cent equals $\frac{1}{100}$ of a dollar and $\frac{1}{10}$ of $\frac{1}{100}$ equals $\frac{1}{1000}$. So \$.001 equals $\frac{1}{10}$ of a cent. This shows that $\$.34\frac{1}{10}$ equals \$.341. Does $\$.23\frac{9}{10}$ equal \$.239?

3. Write $\$.86\frac{1}{10}$ without using the fraction $\frac{1}{10}$. \$.861

In writing dollars and cents, a figure in thousandths place represents tenths of a cent. Emphasize.

4. Study these numbers:

$\$.27\frac{3}{10}$ may be written as \$.273.
$\$.54\frac{6}{10}$ may be written as \$.546.
$\$.93\frac{9}{10}$ may be written as \$.939.
$\$.62\frac{1}{2}$, or $\$.62\frac{5}{10}$, may be written as \$.625.

The number $\$.62\frac{1}{2}$ must first be thought of as $\$.62\frac{5}{10}$ before it can be written as \$.625. Ask pupils "why."

Answers to ex. 5-7 are given in order at end of each example.

5. Write each of these another way: $\$.38\frac{7}{10}$, $\$.63\frac{5}{10}$, $\$.37\frac{1}{2}$, $\$.45\frac{3}{10}$, $\$.52\frac{1}{2}$, $\$.09\frac{6}{10}$, $\$1.43\frac{1}{2}$. \$.387; \$.635; \$.375; \$.453; \$.525; \$.096; \$1.435

6. Write each, expressing tenths of a cent in fractional form: \$.263, \$.738, \$.245, \$.536, \$.191, \$.125, \$.342. $\$.26\frac{3}{10}$; $\$.73\frac{4}{5}$; $\$.24\frac{1}{2}$; $\$.53\frac{3}{5}$; $\$.19\frac{1}{10}$; $\$.12\frac{1}{2}$; $\$.34\frac{1}{5}$

7. Write each in two other ways: \$1.495, \$.075, \$.625, \$4.375, $\$.62\frac{1}{2}$, \$.094, \$.337, \$2.184. $\$1.49\frac{5}{10}$, $\$1.49\frac{1}{2}$; $\$.07\frac{5}{10}$, $\$.07\frac{1}{2}$, $7\frac{1}{2}$¢; $\$.62\frac{5}{10}$, $62\frac{1}{2}$¢; $\$4.37\frac{5}{10}$, $\$4.37\frac{1}{2}$; $\$.09\frac{4}{10}$, $\$.09\frac{2}{5}$, $9\frac{2}{5}$¢; $\$.33\frac{7}{10}$, $33\frac{7}{10}$¢; $\$2.18\frac{4}{10}$, $\$2.18\frac{2}{5}$

Review first, using play money or diagrams, that 1 dime is $\frac{1}{10}$ of a dollar, and 1 cent is $\frac{1}{100}$ of a dollar. Then follow development as given, discussing ex. 2 explanation thoroughly.

Extend multiplication of whole numbers to 4-figure multiplicands and 3-figure multipliers.

Multiplying Larger Numbers

1. A hotel serves an average of 2175 meals per day in its dining room. How many meals does the hotel serve in 365 da.? 793,875

2. The hotel uses an average of 3300 eggs a day. At this rate, how many eggs would be used in 365 da.? 1,204,500

3. There are 360 eggs in a case of eggs. Does the hotel use about 3345, 3346, or 3347 cases of eggs in a year? See ex. 2. 3346

4. Find the mistakes in these examples. Copy the multiplicand and multiplier on your paper and do the work correctly:

See G-59.

6548	7003	6149	2670
475	608	740	830
32740	56024	245960	80100
45836	42018	42043	21360
26192	476204	4450260	293700
3109300			

Emphasize importance of checking.

Multiply. Check by going over the work:

5.	2407	3586	1946	5687	9613
	135	803	217	693	450
	324,945	2,879,558	422,282	3,941,091	4,325,850
6.	7593	2018	6874	3502	5280
	259	893	974	467	120
	1,966,587	1,802,074	6,695,276	1,635,434	633,600
7.	2941	1849	4780	5378	5073
	736	395	628	104	370
	2,164,576	730,355	3,001,840	559,312	1,877,010
8.	9256	2603	9412	3081	2945
	685	129	841	376	940
	6,340,360	335,787	7,915,492	1,158,456	2,768,300
9.	5962	3790	4976	4848	1396
	751	258	406	515	830
	4,477,462	977,820	2,020,256	2,496,720	1,158,680
10.	1030	4875	2387	1800	1973
	295	802	637	784	190
	303,850	3,909,750	1,520,519	1,411,200	374,870

More Practice. See ㉔ on page 318.

Do ex. 1-3 with pupils, emphasizing reasons for placement of partial products (place value of multiplier). Have volunteers put corrected examples for ex. 4 on board, and explain them, step by step. Assign ex. 5-10 as independent work.

Present problems dealing with decimal fractions.

Mixed Problems

1. During a storm 4.8 in. of snow fell on Friday and 2.5 in. fell on Saturday. In all, how many inches of snow fell? 7.3

2. At 60¢ an hour, how much should Betty receive for taking care of Mrs. Lake's baby for 3 hr. 30 min.? $2.10

3. Traveling at the rate of 460 mi. an hour, how far can an airplane fly in 5 hr.? 2300 mi.

4. Mr. Hunt drove a distance of 165 mi. in 4 hr. What was his average speed for the trip? 41$\frac{1}{4}$ mi.

5. A sea mile is 6076.10 ft. long. How many feet longer than a land mile is a sea mile? 796.10

6. What is the perimeter of a rectangular field 96.8 ft. long and 45.5 ft. wide? 284.6 ft.

7. In cooking a roast Mrs. Case allows 20 min. per pound. How many hours must she cook a 7½-pound roast? 2$\frac{1}{2}$

8. Which has the larger area, a rectangle 12 ft. by 18 ft. 6 in. or a square 15 ft. on a side? The square How much larger? 3 sq. ft.

9. In ex. 8, which has the larger perimeter, the square or the rectangle? The rectangle How much larger? 1 ft.

10. Mrs. White bought 3½ lb. of potatoes at 8¢ a pound, ¾ lb. of meat at 59¢ a pound, and a bag of carrots for 15¢. How much was her bill? 88¢

11. Ann bought a pair of play shoes marked $6.00. She paid ¼ less than the marked price. How much did Ann pay for the play shoes? $4.50

12. Each of the 48 passengers on an airplane trip paid $12.37 for his ticket. How much did they pay all together? $593.76

13. In one week Mr. Cook made five business trips in his car. The distances were 71.4 mi., 35.8 mi., 48.2 mi., 37.0 mi., and 61.9 mi. How many miles in all did Mr. Cook drive his car on business trips that week? 254.3

Have pupils note uses of decimal fractions in these problems (measuring snowfall, distance, money). Have pupils do problems independently, and observe pupils to note difficulties. Let volunteers explain their solutions to problems.

Present second sets of improvement tests in multiplication and division.

Improving by Practice

Multiplication Test 2a.

Time: 5 min. after copying.

1.	594	953	496	708	837	467	
	465	319	208	694	825	730	⑥
	276,210	304,007	103,168	491,352	690,525	340,910	

Multiplication Test 2b.

Time: 5 min. after copying.

2.	821	309	426	574	957	632	
	378	257	195	403	896	460	⑥
	310,338	79,413	83,070	231,322	857,472	290,720	

Multiplication Test 2c.

Time: 5 min. after copying.

3.	382	956	785	802	916	641	
	946	703	512	183	456	890	⑥
	361,372	672,068	401,920	146,766	417,696	570,490	

Division Test 2a.

Time: 4 min. after copying.

4.	58 42)2436	79 25)1975	64 R 5 69)4421	
5.	29 58)1682	83 R 10 71)5903	75 37)2775	⑥

Division Test 2b.

Time: 4 min. after copying.

6.	74 34)2516	65 R 13 59)3848	83 76)6308	
7.	27 R 3 68)1839	92 43)3956	69 25)1725	⑥

Division Test 2c.

Time: 4 min. after copying.

8.	53 R 7 61)3240	74 49)3626	86 74)6364	
9.	67 56)3752	58 R 6 25)1456	99 38)3762	⑥

To the Teacher. In ex. 4–9, pupils should write R before remainders.

Have pupils copy examples before test is given and instruct them to copy carefully and legibly (see also pages 74 and 95). Group pupils who had errors to help them determine causes, before assigning remedial work. Remind pupils to record scores.

Present review of column addition of whole numbers and mixed decimal numbers. Quickly review place value and order of addition (thousandths to thousandths, and so on).

Review of Addition

1. During one week Henry kept a record of how far he rode his bicycle each day. Here is his record: Sunday, 6.3 mi.; Monday, 4.7 mi.; Tuesday, 12.9 mi.; Wednesday, 8.4 mi.; Thursday, 5.0 mi.; Friday, 7.8 mi.; and Saturday, 10.6 mi. Find the total distance that Henry rode his bicycle that week. 55.7 mi.

2. Mr. Hall ordered a new car which has a price of $2459.44. He also ordered for his car a radio at $94.50, a heater at $79.85, directional signals at $18.25, and windshield washers at $15.00. What will be Mr. Hall's total bill? $ 2667.04

3. The four largest states in this country have these areas: Alaska, 586,400 sq. mi.; Texas, 267,339 sq. mi.; California, 158,693 sq. mi.; and Montana, 147,138 sq. mi. Find the total area of these four states. 1,159,570 sq. mi.

Add and check the work:

4.	6.9	22.6	9.13	172.5	56.33	2.125
	.7	1.3	2.25	283.4	81.75	6.500
	7.0	10.8	6.50	100.5	22.46	3.750
	4.3	6.0	4.75	212.9	19.50	8.375
	18.9	40.7	22.63	769.3	180.04	20.750
5.	.37	.007	28.5	6.400	7.221	38.44
	.05	.012	5.6	2.250	4.107	21.57
	.12	.715	11.9	1.375	3.004	19.75
	.95	.125	16.8	.875	9.256	11.33
	.62	.498	9.4	2.500	1.050	10.12
	2.11	1.357	72.2	13.400	24.638	101.21
6.	2952	3179	1243	3793	6185	2328
	4644	2761	4436	4606	3667	4555
	2001	5353	6304	2273	4434	9384
	1694	8320	1453	9745	3785	7867
	8528	2119	3765	2058	9374	1000
	4524	7575	5524	5328	5204	2049
	24,343	29,307	22,725	27,803	32,649	27,183

Results should be recorded on progress cards, giving kinds of errors and causes (adding by endings, carrying, zero difficulties, decimals, and so on).

Review problem solving and problems with missing facts.

What Fact Is Missing?

In each problem a fact is missing which you must know before you can find the answer. Supply a missing fact and work the problem: *

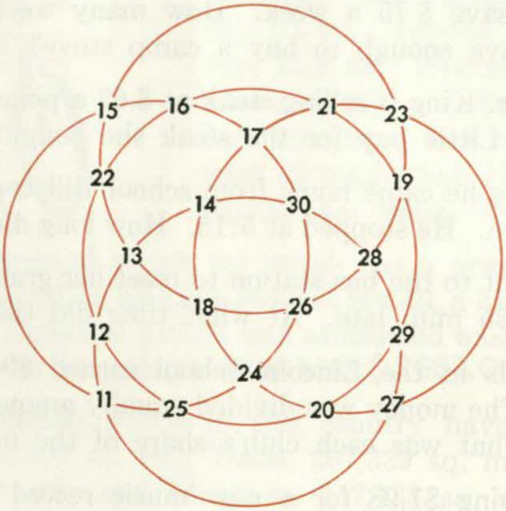
1. Jim can save \$.75 a week. How many weeks will it take him to save enough to buy a camp stove?
2. Today Mr. King is selling steak at \$.69 a pound. How much did Mrs. Little pay for the steak she bought today?
3. As soon as he came home from school Bill began to practice on his horn. He stopped at 5:15. How long did Bill practice?
4. Susan went to the bus station to meet her grandmother. The bus was 35 min. late. At what time did the bus arrive?
5. The pupils in the Lincoln School earned \$94.50 by giving a play. The money was divided equally among all the school clubs. What was each club's share of the money?
6. After paying \$1.98 for a new music record Mary counted her change. How much money did Mary have before she bought the new record?
7. When Mr. Hunt reached home yesterday the speedometer of his car read 4208.3 mi. How far had he driven yesterday?
8. Father paid \$.75 each for movie tickets for each member of the family. How much did Father spend for movie tickets?
9. Mr. Wood pays Bob 60¢ an hour to work in the yard. Bob worked all afternoon. How much did Mr. Wood pay Bob?
10. Jack made a rectangular pen for his dog. It was 10 ft. longer than it was wide. Find the perimeter of the dog pen.
11. A pilot flew 937 mi. from St. Louis to New York. What was his average speed in miles per hour?
12. Ann paid \$.39 for a box of chocolate cookies. What was the cost of 1 cookie?
13. Each pupil in Miss Day's room brought \$.10 for the Red Cross. How much money all together did the pupils bring?

*Answers will vary. Do ex. 1-2 with pupils to assure understanding. Have them complete ex. 3-13. Emphasize that missing fact supplied must make a "sensible" problem. Have different pupils read their problems and let class judge if they are sensible.

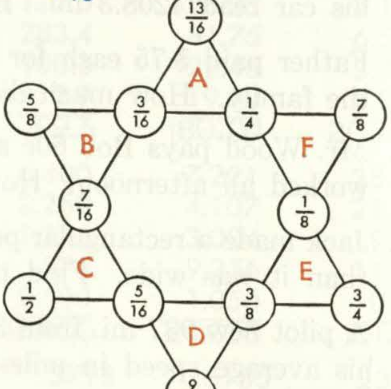
Give an appreciation lesson on magic circles and stars.

Magic Circles and Stars

1. Find the sum of the eight numbers on each of the five circles. If the sums are all equal, these are **magic circles.** The sums are all 164.



2. Add the four fractions on each straight line of the star below. Are the six sums all equal? Yes; $1\frac{15}{16}$ Then add the three fractions at the corners of each of the two large triangles that form the star; that is, add $\frac{13}{16}$, $\frac{3}{4}$, and $\frac{1}{2}$; then add $\frac{5}{8}$, $\frac{7}{8}$, and $\frac{9}{16}$. Are the two sums equal? Yes; $2\frac{1}{16}$ Next add the three fractions at the corners of the small triangle marked A. Then add the three fractions at the corners of each of the other small triangles. Are all these six sums equal? Yes; $1\frac{1}{4}$



3. Make a new magic star by subtracting $\frac{1}{16}$ from each one of the 12 fractions now in the magic star above. Change each fraction to lowest terms before you put it in a circle. See Guide.

Some pupils may need help in locating the five circles. Be sure they add the eight numbers for each circle. In ex. 2 be sure all pupils can locate lines and fractions, as directed. Give help where needed.

Review problem solving involving mixed operations.

Problems

1. Jane rode her new bicycle 8.4 mi. yesterday and 6.5 mi. today. How many miles did Jane ride in the two days? 14.9

2. How many miles farther did Jane ride yesterday than today? 1.9

3. Jane spent \$1.79 for a bicycle basket, \$1.59 for a bicycle light, and \$3.75 for a new tire. How much change did she get from the \$10.00 that she got for her birthday? \$2.87

4. In a large city one of the bus lines carries an average of 6297 passengers per day. How many passengers does this bus line carry in a month of 30 da.? 188,910

5. The airline distance between two cities is 742 mi. If a pilot makes this flight 206 times, how many miles will he fly all together? 152,852

6. It costs $1\frac{1}{2}$¢ for the electricity to run a large fan one hour. How much will it cost to run the fan 8 hr.? 12¢ 3 hr.? $4\frac{1}{2}$¢ $2\frac{1}{2}$ hr.? $3\frac{3}{4}$¢

7. In the last 3 months Peter has saved these amounts: \$11.50, \$9.25, and \$7.75. What is the average amount Peter saved per month? \$9.50

8. This year the population of Williamstown is 10,500. Five years ago Williamstown had a population of 8225. How much has the population grown in five years? 2275

9. Fred wants to paint the floor of the game room. The floor is 20 ft. long and 15 ft. 9 in. wide. How many square feet of floor will Fred have to paint? 315

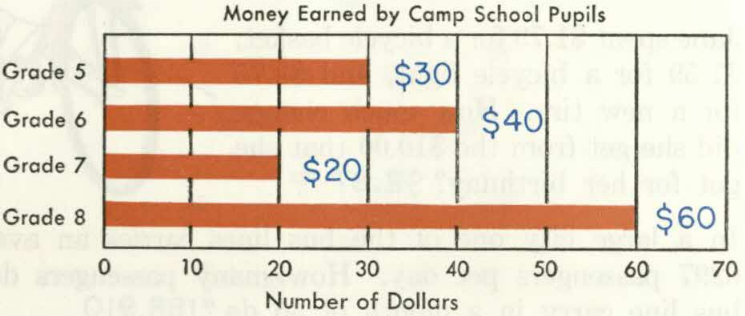
10. Susan needs $3\frac{3}{8}$ yd. of cloth for a dress, $\frac{3}{4}$ yd. of the same cloth for a scarf, and $\frac{1}{2}$ yd. of it for a hat. How many yards of cloth does Susan need? $4\frac{5}{8}$ Could Susan use two pieces of the same cloth if they were $3\frac{1}{2}$ yd. and $1\frac{3}{8}$ yd. long? Yes; see G-61.

Remind pupils to read problems carefully to determine what the problem asks, facts known, process to be used. Discuss problems with pupils who had errors to help discover causes (incorrect computations, wrong process, lack of understanding of problem situation).

Teach how to make bar graphs with large numbers that are first rounded off.

Bar Graphs

1. This year the pupils in the upper grades of the Camp School are earning money to help buy a new motion picture projector for the school. The bar graph below was drawn to show the amounts earned by each grade, to the **nearest** $10, by the middle of the year. Read the graph and tell about how much each grade has earned. Stress.



2. How much, as shown by the graph, have all four grades earned by the middle of the year? $150

3. The actual amounts earned by each grade are as follows: Grade 5, $32; Grade 6, $41; Grade 7, $29; Grade 8, $57. **Round off** each of these numbers to the nearest 10. Is each bar in the above graph the right length? No, the bar for Grade 7 should be $30.

4. At the Smith School the following number of tickets to the school play were sold by the pupils in these grades: Grade 3, 33; Grade 4, 39; Grade 5, 42; Grade 6, 68. Draw a bar graph like the one above, showing the number of tickets sold by each grade. Before drawing the graph round off each number to the nearest 10. See G-62.

In ex. 4-6 be sure pupils label their graphs and scales used.

5. Draw a bar graph to show the newspapers sold each day by these five boys: John, 72; Peter, 49; Henry, 91; George, 52; Tom, 63. Round off each number to the nearest 10. See G-62.

6. The lengths of four large ships, at the water line, are: *Queen Mary,* 975 ft.; *United States,* 917 ft.; *America,* 664 ft.; *Independence,* 638 ft. Draw a bar graph to compare these lengths. Round off each number to the nearest 100. See G-62.

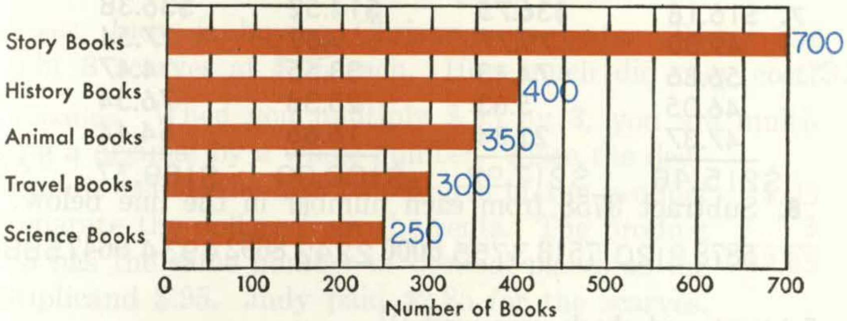
First review how to round off 2-figure numbers to nearest ten or hundred. In discussing ex. 1-3, point out importance of having title for graph and label for scale. Have pupils do ex. 4-6 and check their work to give individual help if needed.

Bar Graphs

1. When the number 392 is rounded off to the nearest 50, it becomes 400 because 392 is closer to 400 than it is to 350. If the number 241 is rounded off to the nearest 50, it becomes 250 because 241 is closer to 250 than 200. Likewise, 615, if rounded off to the nearest 50, becomes 600. Tell what each of these numbers will become if rounded off to the nearest 50: 265 250 384 400 213 200 794 800 115 100

2. The graph below shows how many books of each of 5 kinds there are in the school library. Read the graph and tell about how many books of each kind there are.

Kinds of Books in Library



3. The graph in ex. 2 was drawn by using round numbers. The actual number of books of each kind in the school library is as follows: 692 story books, 382 history books, 355 animal books, 284 travel books, 236 science books. Round off each of these numbers to the nearest 50. Then see if each bar in the above graph is the right length. The bars are right.

4. Draw a bar graph like the one above, showing the number of pupils in each of these schools: Camp, 385; Field, 512; Washington, 689; Longfellow, 448. Before drawing the graph, round off each number to the nearest 50. See G–63.

5. Draw a bar graph like the one above, showing the number of stamps each boy has: Jim, 257; Joe, 365; Peter, 395; Fred, 548; Dick, 610. Before drawing the graph, round off each number to the nearest 50. See G–63.

Do ex. 1–3 as class activity to ascertain that pupils understand how to round off numbers to nearest 50. Contrast graph in ex. 2 with one in ex. 1 on page 144, to show that scale selected depends on range of numbers and space available.

Review fundamental operations with whole numbers.

Keeping in Practice

Copy in columns and add or subtract:

1. 1652 + 789 + 2203 + 937 + 756 6337 8560 − 4592 3968
2. 6478 + 749 + 4375 + 343 + 310 12,255 5326 − 3759 1567
3. 1549 + 429 + 6984 + 262 + 677 9901 7000 − 6954 46
4. How many more than 769 stamps are 1000 stamps? 231
5. What is the difference between $183.75 and $95.86? $87.89
6. Find the sum of $225.20, $875.73, and $134.89. $1235.82

Add and check your work:

7.	$16.18	$36.75	$14.52	$36.38	$32.47
	49.00	79.77	9.89	7.54	51.26
	56.86	74.43	33.55	14.47	67.94
	46.05	5.63	25.38	76.54	81.04
	47.37	21.34	16.66	54.44	36.39
	$215.46	$217.92	$100.00	$189.37	$269.10

8. Subtract 3758 from each number in the line below:

5878 2120 7513 3755 6000 2242 8692 4934 9647 5889 4236 478

Subtract and check your work:(1)

9.	4216	5572	4353	8428	7413
	2384	4853	1499	4369	2436
(1),(2)	1832;6600	719;10,425	2854;5852	4059;12,797	4977;9849
10.	3122	5000	8528	8387	6271
	1999	2327	2662	1597	5795
	1123;5121	2673;7327	5866;11,190	6790;9984	476;12,066
11.	8200	3523	5009	6000	5590
	6211	2547	2823	2486	1894
	1989;14,411	976;6070	2186;7832	3514;8486	3696;7484

12. Add the numbers in ex. 9–11.(2)

Divide. Use any remainder to give a fraction in the quotient: Stress.

13. $\overset{76}{59\overline{)4484}}$ $\overset{385}{17\overline{)6545}}$ $\overset{159\frac{20}{33}}{33\overline{)5267}}$ $\overset{678}{25\overline{)16950}}$ $\overset{689}{28\overline{)19292}}$

14. $\overset{35\frac{2}{41}}{41\overline{)1437}}$ $\overset{136\frac{19}{56}}{56\overline{)7635}}$ $\overset{103\frac{49}{62}}{62\overline{)6435}}$ $\overset{578}{19\overline{)10982}}$ $\overset{960\frac{39}{77}}{77\overline{)73959}}$

Check papers carefully and analyze errors so that you may give remedial help where needed. Have pupils check own papers to discover and correct mistakes. Have them do computations aloud to check understanding. Let others work on magic squares.

Teach how to multiply decimals by whole numbers (pages 147–148). First have pupils use materials (see page 122) to find answers to simple problems dictated by you. Let them discover how to solve problem without materials.

Multiplying Decimals

1. Problem Jim lives 1.3 mi. from the ball park. How far does he walk going to the ball park and back? 2.6 mi.

Explanation When you multiply a decimal like 1.3 by a whole number, the product must have the same number of decimal places as the decimal itself. Since 1.3 has one decimal place, the product must have one decimal place. So place the decimal point before the 6 of 26. The answer is 2.6.

1.3
2
2.6

It is easy to show that 2.6 is the right answer. When you multiply 1.3 by 2, it is the same as adding 1.3 and 1.3. What is the sum of 1.3 and 1.3? 2.6 Jim walks 2.6 mi. in all.

2. Problem Judy is buying Christmas presents. Today she bought 3 scarves at \$.95 each. How much did they cost? \$2.85

Explanation When you multiply \$.95 by 3, you are multiplying a decimal by a whole number. Place the decimal point before the last two figures of the product to separate the dollars from the cents. The product \$2.85 has the same number of decimal places as the multiplicand \$.95. Judy paid \$2.85 for the scarves.

\$.95
3
\$2.85

3. Study these examples: Have pupils check some by addition and by using common fractions.

3.7	.7	.43	.05	.024	.008
4	4	5	7	6	4
14.8	2.8	2.15	.35	.144	.032

In the first example in ex. 3, show that 14.8 is the right answer by adding these numbers: 3.7 + 3.7 + 3.7 + 3.7.

Practice Exercises. See ㉕ on page 318. Use to reinforce understanding.

Stress understanding, not memorization of following.

To multiply a decimal by a whole number, multiply as with whole numbers. Then, beginning at the right, point off as many decimal places in the product as there are decimal places in the multiplicand.

After prelesson activity, discuss ex. 1–2 with pupils. Have them also use other methods (addition, using common fractions, materials) to find answers. Lead pupils to discover above boxed statement through discussion of ex. 3 and other examples.

Continue work of page 147. Introduce unit of speed, knot. First explain that distances on the ocean are measured in sea miles, while those on land are measured in land miles (1 sea mile = 1.15 land miles).

Problems and Practice

1. The **knot** is a unit for measuring the speed of a boat or a ship. **A speed of 1 knot is equal to a speed of 1.15 mi. per hour.** If a ship travels at an average speed of 14 knots, what is its speed in miles per hour? 16.1

Stress. ▶ It is incorrect to speak of the speed of a boat as 14 knots **per hour;** it is correct to say that the speed of the boat is 14 **knots.**

2. What is the speed in miles per hour of a ship that travels at a speed of 17 knots? 19.55

3. On one trip across the Atlantic Ocean the *United States* had an average speed of 35 knots. What was her speed in miles per hour? 40.25

4. A sheet of paper is .007 in. thick. How thick are 25 such sheets placed together in a pile? .175 in.

5. In 1935 a specially built automobile named *Bluebird* averaged 4.65 mi. per minute. At that rate, how far would it go in 6 min.? in 9 min.? 41.85 mi.
27.90 mi.

Have pupils explain position of decimal point by approximation: product of 6 × 28.7 must be more than 172 (6 × 28) and less than 174 (6 × 29), therefore it must be 172.2.

Multiply. Check your work by going over it:

6.	28.7 6 172.2	31.7 9 285.3	.006 9 .054	9.36 2 18.72	8.52 9 76.68	.437 6 2.622
7.	63.1 5 315.5	.005 7 .035	.207 4 .828	6.54 8 52.32	.436 4 1.744	.059 5 .295
8.	4.76 37 176.12	93.7 58 5434.6	.289 37 10.693	6.09 16 97.44	.812 84 68.208	.316 73 23.068
9.	.075 17 1.275	9.58 36 344.88	.284 52 14.768	.459 49 22.491	1.06 67 71.02	.057 82 4.674

Emphasize that knot is "unit of speed," not unit of distance (see G-64). One knot means a speed of 1 sea mile in 1 hour. Do ex. 1-5 with pupils. Assign ex. 6-9 as independent work.

Multiplying a Decimal by a Decimal

1. Problem Mr. Hunt finds that on the average he can drive his car 18.5 mi. on each gallon of gasoline. How many miles can he drive on 4.1 gal.? 75.85

Explanation Multiply 18.5 by 4.1 as you multiply whole numbers. The product is 7585. To find where to put the decimal point, make a rough estimate of the answer by multiplying the 18 of 18.5 by the 4 of 4.1. This gives 72. Since the answer should be a little more than 72, the decimal point should be placed after 75, as shown at the right. Mr. Hunt can drive 75.85 mi. on 4.1 gal. of gasoline.

$$\begin{array}{r} 18.5 \\ \underline{4.1} \\ 185 \\ \underline{740} \\ 75.85 \end{array}$$

2. Another way to multiply these numbers is to change 18.5 to $18\frac{1}{2}$ and 4.1 to $4\frac{1}{10}$. Then multiply as shown below:

$$4\tfrac{1}{10} \times 18\tfrac{1}{2} = \tfrac{41}{10} \times \tfrac{37}{2} = \tfrac{1517}{20} = 75\tfrac{17}{20}$$

The answer is $75\frac{17}{20}$, which is the same as 75.85 because $\frac{17}{20} = \frac{85}{100}$. This shows that 75.85 is the correct answer for ex. 1.

3. There is a rule for finding the position of the decimal point in the product. Since there is 1 decimal place in 18.5 and 1 decimal place in 4.1, there are 2 decimal places in 18.5 and 4.1 together. Notice that the product 75.85 also has 2 decimal places in it. Here is the rule:

Stress understanding, not memorization.

To multiply decimals, multiply as with whole numbers. Then, beginning at the right, point off as many decimal places in the product as there are decimal places in the multiplier and the multiplicand together.

Estimate the answers roughly.(1) Then multiply the numbers:(2)

(1) **4.** 9.2 × 7.02 63 8.3 × 8.05 64 5.2 × 81.5 405 6.1 × 70.6 420

(2) 64.584 66.815 423.80 430.66

More Practice. See ㉖ on page 318.

Follow development and explanation as given in ex. 1-2. Before discussing ex. 3, lead pupils to discover generalization by doing few more examples, using estimation (approximation) or common fractions. Use more practice to reinforce understanding.

Multiplying by a Decimal

1. If you multiply 38 by 2.1, you get 798 before placing the decimal point. Without using the rule on page 149, how can you tell which answer is correct? 7.98, 79.8, .798.

By estimating the answer; 79.8

2. Without using the rule, tell whether 4.1 × 19.8 equals 811.8 or 8.118 or 81.18. Tell whether 5.9 × 9.8 equals 578.2 or 57.82 or 5.782.

81.18

57.82

3. Study these examples. Explain the position of the decimal point in each product, first by using the rule and then without using the rule:

Be sure pupils can explain position without using the rule.

8.2	1.17	4.9	.57	.81
2.9	6.3	.2	.4	1.5
7 38	351	.98	.228	405
16 4	7 02			81
23.78	7.371			1.215

If pupils have difficulty in ex. 3, refer them back to common fractions ($.3 \times .3 = .09$, $\frac{3}{10} \times \frac{3}{10} = \frac{9}{10}$), besides estimation.

Multiply. Check by going over your work:

4.	5.8	.65	52	9.6	275	4.17
	3.6	.7	.4	.89	3.5	2.1
	20.88	.455	20.8	8.544	962.5	8.757
5.	2.9	.84	70	7.4	684	8.95
	2.6	.8	.9	.18	6.7	2.5
	7.54	.672	63.0	1.332	4582.8	22.375
6.	1.2	.31	54	4.8	157	1.29
	3.8	.5	.5	.69	.92	5.4
	4.56	.155	27.0	3.312	144.44	6.966
7.	9.1	.42	47	7.3	369	40.9
	7.9	.9	.5	.43	.36	7.3
	71.89	.378	23.5	3.139	132.84	298.57
8.	8.6	.68	57	6.3	13.2	94.3
	3.2	.5	.6	.25	8.9	.46
	27.52	.340	34.2	1.575	117.48	43.378
9.	3.2	.86	80	2.7	50.3	53.6
	.7	.4	.9	.76	8.7	.49
	2.24	.344	72.0	2.052	437.61	26.264
10.	8.3	.27	63	5.2	7.18	4.11
	1.7	.6	.9	.37	1.3	9.2
	14.11	.162	56.7	1.924	9.334	37.812

Have pupils explain position of decimal point through place-value knowledge: product of ones and tenths is tenths (1 decimal place); tenths and tenths is hundredths (2 decimal places), and so on.

1. Problem The speedometer of Mr. Bell's car shows that the trip from his house to his camp is 17.6 mi. How many miles does he drive if he makes this trip 8 times? 140.8

Explanation The rule on page 149 states that the product must have as many decimal places as there are places in the multiplicand and the multiplier together. Can you use the rule in this problem? How many decimal places are there in 17.6? 1 How many decimal places are there in 8? 0 How many decimal places are there in 17.6 and 8 together? 1 Then how many decimal places should there be in the answer? 1 Mr. Bell drives 140.8 mi. if he makes 8 trips between his house and his camp.

$$\begin{array}{r} 17.6 \\ 8 \\ \hline 140.8 \end{array}$$

2. Mr. Bell finds he can drive 17.4 mi. on a gallon of gasoline. How far can he drive on 6 gal. of gasoline? 104.4 mi.

3. If .78 of the weight of a potato is water, how many pounds of water are there in 5 lb. of potatoes? 3.90 in 8 lb.? 6.24

4. The average monthly rainfall for Foxwood last year was 2.78 in. How many inches of rain fell during the year? 33.36

5. Mr. Peck earns $12.50 a day. How much does he earn after working 2.5 days? $ 31.25

6. You can write $12.50 as $12½ and 2.5 days as 2½ days. Using these mixed numbers, find the amount Mr. Peck earns. $ $31\frac{1}{4}$ Is your answer equal to the answer in ex. 5.? Yes

*7. When you travel on land, distances are measured in **miles,** which are sometimes called **land miles.** When you travel on the ocean, distances are measured in **sea miles.** A sea mile is longer than a land mile. 1 sea mile = 1.15 land miles. If you take an ocean voyage of 692 sea miles, how many land miles does that distance equal? 795.80

*See suggestion on G-64 for page 148. In discussing ex. 1 have pupils also use estimation and place value to find number of decimal places. Do other problems orally also in same way.

Teach how to handle zero difficulties in multiplication of decimal by decimal.

Placing the Decimal Point

1. **Problem** Multiply .17 by .4. .068

Explanation When small decimals are multiplied together, it is sometimes difficult to place the decimal point correctly. In the work at the right you know that 4 × 17 = 68. If you follow the rule on page 149, you know that there should be 3 decimal places in the product, counting from the right. Since 68 has only 2 figures, 0 is written before 68 so that there can be 3 decimal places in the product. The answer is .068.

$$\begin{array}{r} .17 \\ \underline{.4} \\ .068 \end{array}$$

2. Another way to do ex. 1 is to write .4 as $\frac{4}{10}$ and .17 as $\frac{17}{100}$. Then multiply the fractions together. The result is $\frac{68}{1000}$, which equals .068 when written as a decimal. So the answer in ex. 1 is right.

$$\frac{4}{10} \times \frac{17}{100} = \frac{68}{1000}$$

3. Multiply .04 by .2, using the rule as was done in ex. 1. .008 Then multiply these decimals by changing them first to fractions, as in ex. 2. $\frac{8}{1000}$ Do you get the same answer either way? Yes

Emphasize.

When the number of decimal places to be pointed off is greater than the number of figures in the product, put as many zeros to the left of the product as are needed to point off correctly.

Multiply these numbers: Have pupils explain or prove decimal-point placement by estimation, place value, using common fractions.

4. .8 × .06 .048 6 × .011 .066 .07 × 1.4 .098 .09 × 2.5 .225
5. .3 × .09 .027 7 × .017 .119 2.1 × .04 .084 .11 × 0.6 .066
6. .9 × .01 .009 4 × .063 .252 .15 × 1.3 .195 .06 × 1.3 .078
7. .7 × .04 .028 3 × .045 .135 .04 × 0.4 .016 3.2 × 0.3 .96
8. .6 × .12 .072 2 × .134 .268 1.7 × .08 .136 0.3 × .03 .009
9. .5 × .11 .055 8 × .012 .096 .14 × 1.2 .168 9.2 × .01 .092
10. .4 × .18 .072 5 × .117 .585 .04 × 6.3 .252 .25 × 0.7 .175

Discuss ex. 1-2 thoroughly with pupils. In ex. 2, pupils should understand that product of two proper fractions is less than either factor because each factor is less than 1, and that same principle applies to multiplication of pure decimals.

Give practice in placing decimal point in product.

Placing the Decimal Point

In ex. 1 to 8, three answers are given for each example but only one answer is correct. Tell which answer is correct. Have pupils explain why answer is correct "without" using rules on pages 147 and 149.

1. 8 × 1.54 equals 1232 or 123.2 or 12.32. 12.32
2. 7 × .947 equals 6.629 or 662.9 or 66.29. 6.629
3. .4 × .7 equals .28 or .028 or 2.8. .28
4. .7 × .05 equals .35 or .035 or 3.5. .035
5. 4 × 32.5 equals 1300 or 130.0 or 13.00. 130.0
6. 6 × 32.8 equals 19.68 or 1.968 or 196.8. 196.8
7. 1.9 × 8.7 equals 165.3 or 16.53 or 1.653. 16.53
8. 3.5 × 4.9 equals 171.5 or 1.715 or 17.15. 17.15

In ex. 9 to 12, the product is given for each example but the decimal point has been dropped. Tell where the decimal point belongs in each product, putting in 0's if necessary. Give the answers orally like this: "Six-point-three": See G–65 for ex. 10, 12.

9.	9	3.2	.08	4.2	6.13	12.3
	.7	7	.7	1.7	1.4	6.9
	63 6.3	224 22.4	56 .056	714 7.14	8582 8.582	8487 84.87
	Six-point-three	Two-two-point-four	Point-o-five-six	Seven-point-one-four	Eight-point-five-eight-two	Eight-four-point-eight-seven
10.	.8	2.4	13	.07	.025	.67
	.7	.24	.09	.6	7	41
	56.56	576.576	117 1.17	42.042	175.175	2747 27.47
11.	.9	11	.35	.16	300	.013
	.1	.06	1.4	.4	.27	6
	9.09	66.66	490.490	64.064	8100 81.00	78 078
	Point-o-nine	Point-six-six	Point-four-nine-o	Point-o-six-four	Eight-one-point-o-o	Point-o-seven-eight
12.	.2	.17	.73	2.6	45.4	.50
	.4	1.5	.2	.25	.06	23
	8.08	255.255	146.146	650.650	2724 2.724	1150 11.50

13. Multiply .02 by .2 by using the rule. .004 Then do the example again by changing each decimal to a common fraction and multiplying. $\frac{4}{1000}$ Do you get the same answer as before? Yes

Have pupils explain decimal-point placement in ex. 9–12. Be sure they understand "reasons" for placement. Reteach now, if needed, using materials, common fractions, approximation place value.

Provide mixed practice with emphasis on common and decimal fractions.

Mixed Practice

1. How many ounces are there in 4 lb. 12 oz.? 76

2. What part of a gallon is 2 quarts? $\frac{1}{2}$

3. Find the product of $2\frac{2}{3}$ and $2\frac{1}{4}$. 6

4. How much less than $1000.00 is $768.34? $231.66

5. Find the sum of 6387, 2941, 6003, and 2906. 18,237

6. Find the difference between $137\frac{1}{8}$ and $124\frac{3}{4}$. $12\frac{3}{8}$

7. Which is more, $\frac{3}{4}$ of 120 or $\frac{2}{3}$ of 120? $\frac{3}{4}$ of 120 How much more? 10

8. How many cents are there in 3 half dollars, 13 quarters, 6 dimes, and 11 nickels? 590¢

9. Find the area and the perimeter of a garden that is 28 ft. long and $22\frac{1}{2}$ ft. wide. Area = 630 sq. ft.; perimeter = 101 ft.

10. Bob's father says it costs $.094 a mile to run his truck. What does it cost to run the truck 125 mi.? $11.75

11. Show you know the meaning of each word or group of words by using it in a sentence or by giving an example of it:

tenth
product
average

multiplicand
decimal point
mixed decimal

tenth of an inch
hundredths place
common fraction

Add:

12.
6.75
10.25
7.50
14.18
2.60
5.24
46.52

Multiply:

13.
26.3
2.45
64.435

Subtract:

14.
$11\frac{1}{4}$
$5\frac{1}{2}$
$5\frac{3}{4}$

Add:

15.
$2\frac{1}{3}$
$3\frac{3}{4}$
$1\frac{5}{6}$
$2\frac{1}{2}$
$5\frac{1}{4}$
$15\frac{2}{3}$

Divide:

16. $6\overline{)15432}$ 2572

Divide:

17. $32\overline{)16192}$ 506

Add:

18.
$7284.34
1715.66
$9000.00

Multiply:

19. $11 \times 3\frac{1}{4}$ $35\frac{3}{4}$

Subtract:

20.
800000
289943
510,057

Multiply:

21. $5\frac{1}{4} \times 3\frac{1}{3}$ $17\frac{1}{2}$

Urge better pupils to do some examples mentally. Note areas of class or individual weaknesses and review or reteach accordingly. Check understandings as evidenced by ex. 11.

Extend problems without numbers to include two- and three-step problems. After deciding on processes, have pupils suggest numbers to be used to make "sensible" problems, for class to solve.

Problems without Numbers

Tell whether you add, subtract, multiply, or divide to get the answer. If the problem has two or three steps, tell what you do in each step. Do more work of this type with pupils who show lack of understanding.

1. You know how much money your school made at the fair. You also know how much it cost to run the fair. If half the money that was left is used to buy new books for the library, how can you find out how much money will be used for new books? Subtract; multiply by $\frac{1}{2}$

2. You know the cost of a yard of velvet and also the cost of a yard of linen. How can you find the total cost of some velvet and some linen if you know how many yards of each you wish to buy? Multiply; multiply; add

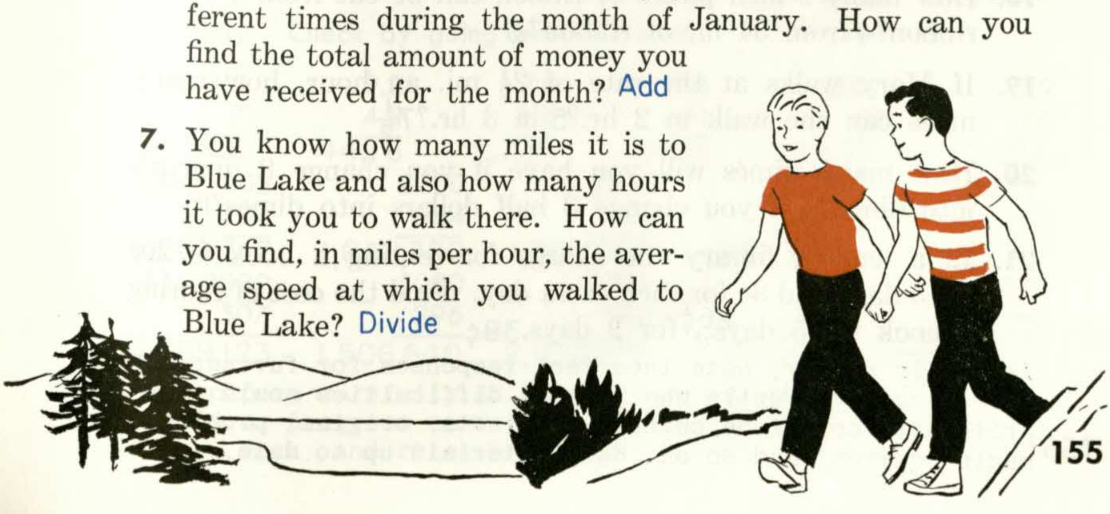
3. You know the distance you are planning to ride on a bicycle trip. You also know your average speed in miles per hour. How can you find the number of hours it will take you to make the trip? Divide

4. You know the number of feet in the length and also in the width of your father's rectangular cow pasture. How can you find the number of feet of fence needed to enclose the pasture? Add

5. You know the price of a small radio you would like to buy. You also know how much money you have saved and that it is not enough. How can you find how much more money you need to buy the radio? Subtract

6. You know the amount of money you have received at different times during the month of January. How can you find the total amount of money you have received for the month? Add

7. You know how many miles it is to Blue Lake and also how many hours it took you to walk there. How can you find, in miles per hour, the average speed at which you walked to Blue Lake? Divide



Provide activity in mental arithmetic.

Oral Practice

1. Add .7, .4, .5, .9, and .3. 2.8
2. How much more than $6\frac{3}{4}$ is 9? $2\frac{1}{4}$

8.6 .86

3. Multiply 4.3 by 2, by .2, by .02. .086
4. Find the sum of $\frac{5}{12}$, $\frac{1}{12}$, $\frac{5}{12}$, and $\frac{7}{12}$. $1\frac{1}{2}$

7 hundredths 2 thousandths

5. Read these numbers: .07, 4.29, .002, 7.019.

4 and 29 hundredths 7and 19thousandths

6. Add $3\frac{1}{4}$ and $6\frac{3}{4}$; 10 $2\frac{1}{3}$ and $4\frac{1}{3}$; $6\frac{1}{4}$ and $2\frac{1}{2}$. $8\frac{3}{4}$

$6\frac{2}{3}$ $12\frac{1}{2}$

7. Find $\frac{1}{2}$ of each number: 18 9 25 $2\frac{1}{2}$ $1\frac{1}{4}$ $1\frac{1}{2}$ $\frac{3}{4}$ $2\frac{2}{3}$ $1\frac{1}{3}$
8. Find $\frac{3}{4}$ of each number: 16 12 24 18 36 27 44 33 80 60
9. Find the cost of twenty 4-cent stamps. 60¢

53 64

10. Add 8 to each number: 63 71 45, 56, 89, 78 86

97

11. How many minutes are there in 1 hr. 14 min.? 74

3R1 9R1

12. Divide each number by 4: 20 5 32 8 13, 37, 23 5R3

1 billion, 703 million, 45 thousand, 9

13. Read these numbers: 42,760,184; 1,703,045,009.

42 million, 760 thousand, 184

14. Read these numbers: MDCCV, MCMLX, MDCXII. 1612

1705 1960

15. How many inches are there in 2 ft.? in 6 ft.? in $\frac{1}{2}$ ft.? 6

24 72

16. Place a decimal point in the number so that this statement will be sensible: In an hour Jim rode his bicycle 85 mi. 8.5
17. Peter can walk a mile in 20 min. At this rate, how many miles an hour can he walk? 3
18. How many 9-inch pieces of ribbon can be cut from 1 yd. of ribbon? 4 from 54 in. of ribbon? 6
19. If Mary walks at the rate of $2\frac{1}{2}$ mi. an hour, how many miles can she walk in 2 hr.? 5 in 3 hr.? $7\frac{1}{2}$
20. How many dimes will you have if you change 8 quarters into dimes? if you change 3 half dollars into dimes? 15

20

21. In a lending library the charge for renting a book is 20¢ for 3 days and 3¢ for each extra day. Find the cost of renting a book for 5 days? for 9 days. 38¢

26¢

As pupils answer, note incorrect responses for further review or reteaching. Pupils who have no difficulties could work at arithmetic corner on puzzles, projects, original problems, magic squares, and so on. Keep materials up to date.

See G-66 for correlation of examples with aims.

Chapter Review

Change these fractions to decimals:

1. $\frac{17}{100}$ .17 $\frac{734}{1000}$ .734 $\frac{3}{10}$ .3 $\frac{7}{100}$ .07 $\frac{23}{1000}$ .023 $\frac{7}{1000}$ .007

2. $\frac{4}{100}$ .04 $\frac{12}{1000}$ .012 $\frac{9}{10}$ .9 $\frac{35}{100}$ .35 $\frac{5}{1000}$ .005 $\frac{193}{1000}$ .193

Change these decimals to fractions:

3. .47 $\frac{47}{100}$ .80 $\frac{4}{5}$ .5 $\frac{1}{2}$ .348 $\frac{87}{250}$ .075 $\frac{3}{40}$ .002 $\frac{1}{500}$

4. .03 $\frac{3}{100}$ .08 $\frac{2}{25}$ .7 $\frac{7}{10}$ .280 $\frac{7}{25}$ .039 $\frac{39}{1000}$ .001 $\frac{1}{1000}$

Add up. Check by adding down:

5.	4.6	.476	16.25	.253	7.00	2.375
	1.7	.182	6.44	.380	2.63	.250
	3.8	.008	10.50	.125	4.80	6.500
	10.1	.666	33.19	.758	14.43	9.125
6.	3.2	.563	42.13	.127	9.29	1.246
	1.4	.007	9.17	.059	1.46	7.500
	7.9	.080	18.46	.710	5.23	.491
	6.7	.493	7.60	.408	8.00	1.260
	19.2	1.143	77.36	1.304	23.98	10.497

Subtract. Check the work by adding:

7.	8.0	.375	18.25	.625	8.00	5.125
	4.5	.207	11.86	.250	3.67	3.750
	3.5	.168	6.39	.375	4.33	1.375
8.	8.1	19.0	23.50	.851	7.05	9.000
	3.7	8.6	9.29	.327	1.28	1.275
	4.4	10.4	14.21	.524	5.77	7.725

Multiply. Check by going over the work:

9.	8.5	9.2	.74	5.6	.38	17.9
	7	4.8	3.7	.24	90	.56
	59.5	44.16	2.738	1.344	34.20	10.024

10.	1803	2730	3258	1675	4239
	704	384	417	508	260
	1,269,312	1,048,320	1,358,586	850,900	1,102,140
11.	2089	5090	3006	1908	5938
	507	296	983	725	960
	1,059,123	1,506,640	2,954,898	1,383,300	5,700,480

Check papers carefully to determine kinds of errors and note results on progress cards. Use review to determine readiness for new work, and reteach (stress understandings) as needed.

A Problem Test

1. Betty needs $\frac{3}{4}$ cup of nuts for her recipe for chocolate candy. How many cups of nuts does she need for $\frac{2}{3}$ the recipe? $\frac{1}{2}$

2. Fred had a 50-foot roll of wire. First he cut off $8\frac{1}{2}$ ft. of it and then he cut off $12\frac{3}{4}$ ft. How much wire did Fred have left in the roll? $28\frac{3}{4}$ ft.

3. A one-way ticket by air from New York to London costs \$270. A round-trip ticket costs \$486. How much less is a round-trip ticket than two one-way tickets? \$54

4. For our class party we need 1 gal. of ice cream. How much cheaper is 1 gal. at \$2.25 than 4 qt. at \$.65 a quart? \$.35

5. Mrs. Wood bought a 10-yard roll of ribbon. She gave Mary and Ann each $1\frac{3}{4}$ yd. of the ribbon. How many yards of ribbon did Mrs. Wood have left? $6\frac{1}{2}$

6. Find the cost of $6\frac{5}{8}$ lb. of ham at \$.49 a pound. $\$3.24\frac{5}{8}$, or \$3.25

7. This week Bill rode his new bicycle 9.2 mi., 4.5 mi., and 10.6 mi. How many miles did he ride all together? 24.3

8. Mr. Johnson is allowed \$.085 a mile when he drives his car on business. On a business trip of 350 mi., how much should the allowance be? \$29.75

9. Last year in May 8.4 in. of rain fell in Northfield. This year 13.2 in. fell in May. How many more inches of rain fell in May this year than last? 4.8

10. Judy sold 75 packages of seeds at \$.12 a package. When she counted her money, she had 4 one-dollar bills, 13 quarters, 16 dimes, and 15 pennies. Was this correct? \$9.00, yes

How many problems did you get right? Look below to find out what your score means. Have pupils record scores (see page 41).

SCORE	0–5	6–7	8–9	10
	You need help	Fair	Good	Excellent

Instruct pupils to read problems carefully (see page 143). Try to hold individual conferences with pupils who had mistakes to determine causes and pupils' understanding of problem situations, before setting up remedial programs.

Present diagnostic tests (pages 159-160) with practice-page references.

How Much Have You Learned?

If you miss more than one example in a row, turn to the Practice Pages for that row. Emphasize importance of checking all work.

Divide and check:

				Practice Pages
1.	643 R21 32)20597	935 R18 24)22458	7049 R56 73)514633	31, 35
2.	817 R20 69)56393	384 R29 47)18077	8294 R28 68)564020	34

Change these decimals to fractions:

3.	.85 $\frac{17}{20}$	.06 $\frac{3}{50}$	.072 $\frac{9}{125}$	.405 $\frac{81}{200}$	135

Add up. Check by adding down:

4.	1.7 8.3 5.6 4.5 20.1	5.62 2.67 4.93 3.08 16.30	\$3.85 3.45 .88 2.74 \$10.92	4.375 2.250 6.400 9.000 22.025	129, 130

Subtract. Check by adding:

5.	8.0 5.3 2.7	6.25 3.40 2.85	\$9.00 4.75 \$4.25	6.125 4.250 1.875	131, 132

Multiply and check:

6.	1.8 4 7.2	.09 6 .54	.004 7 .028	.147 28 4.116	148
7.	.63 .7 .441	.65 1.6 1.040	4.29 3.5 15.015	31.9 .29 9.251	150
8.	.24 .4 .096	3.2 .03 .096	.025 5 .125	0.12 .6 0.072	152
9.	1694 925 1,566,950	4205 613 2,577,665	2006 407 816,442	2530 980 2,479,400	137

Use these pages as mid-year test in arithmetic skills. Results should be noted on progress cards and compared with previous ones. Clear up difficulties before assigning practice pages.

How Much Have You Learned?

If you miss more than one example in a row, turn to the Practice Pages for that row.

Practice Pages

Add and check the work:

1. $\begin{array}{r}3\frac{1}{8}\\ \underline{8\frac{3}{4}}\\ 11\frac{7}{8}\end{array}$ $\begin{array}{r}4\frac{7}{8}\\ \underline{4\frac{7}{8}}\\ 9\frac{3}{4}\end{array}$ $\begin{array}{r}5\frac{1}{2}\\ \underline{7\frac{3}{4}}\\ 13\frac{1}{4}\end{array}$ $\begin{array}{r}8\frac{5}{6}\\ \underline{5\frac{3}{4}}\\ 14\frac{7}{12}\end{array}$ $\begin{array}{r}6\frac{3}{4}\\ \underline{9\frac{2}{3}}\\ 16\frac{5}{12}\end{array}$ 62–65, 75, 76

Subtract and check the work:

2. $\begin{array}{r}7\frac{3}{4}\\ \underline{3\frac{1}{2}}\\ 4\frac{1}{4}\end{array}$ $\begin{array}{r}9\frac{1}{4}\\ \underline{2\frac{3}{4}}\\ 6\frac{1}{2}\end{array}$ $\begin{array}{r}5\frac{1}{3}\\ \underline{1\frac{5}{6}}\\ 3\frac{1}{2}\end{array}$ $\begin{array}{r}8\frac{2}{3}\\ \underline{2\frac{1}{4}}\\ 6\frac{5}{12}\end{array}$ $\begin{array}{r}9\frac{1}{6}\\ \underline{5\frac{3}{4}}\\ 3\frac{5}{12}\end{array}$ 66–71, 77

Multiply and check the work:

3. $\frac{5}{8} \times 32$ 20 $\frac{3}{4} \times 24$ 18 $\frac{1}{2} \times 14$ 7 87

4. $2\frac{3}{4} \times 8$ 22 $4\frac{1}{2} \times 6$ 27 $1\frac{5}{8} \times 24$ 39 88

5. $\frac{2}{3} \times 20$ $13\frac{1}{3}$ $\frac{3}{5} \times 11$ $6\frac{3}{5}$ $\frac{5}{6} \times 13$ $10\frac{5}{6}$ 89

6. $1\frac{1}{2} \times 15$ $22\frac{1}{2}$ $2\frac{1}{3} \times 10$ $23\frac{1}{3}$ $4\frac{1}{4} \times 15$ $63\frac{3}{4}$ 91

7. $6 \times \frac{1}{5}$ $1\frac{1}{5}$ $4 \times \frac{5}{8}$ $2\frac{1}{2}$ $15 \times \frac{2}{3}$ 10 92

8. $9 \times 4\frac{1}{2}$ $40\frac{1}{2}$ $6 \times 2\frac{1}{3}$ 14 $5 \times 1\frac{3}{4}$ $8\frac{3}{4}$ 93

9. $\frac{1}{4} \times \frac{1}{3}$ $\frac{1}{12}$ $\frac{2}{3} \times \frac{4}{5}$ $\frac{8}{15}$ $\frac{3}{8} \times \frac{1}{2}$ $\frac{3}{16}$ 100–102

10. $\frac{1}{6} \times \frac{3}{8}$ $\frac{1}{16}$ $\frac{2}{3} \times \frac{3}{5}$ $\frac{2}{5}$ $\frac{3}{4} \times \frac{2}{5}$ $\frac{3}{10}$ 104

11. $6 \times \frac{2}{3}$ 4 $8 \times \frac{3}{4}$ 6 $6 \times \frac{7}{12}$ $3\frac{1}{2}$ 104

12. $\frac{3}{5} \times \frac{1}{3}$ $\frac{1}{5}$ $\frac{4}{5} \times \frac{5}{8}$ $\frac{1}{2}$ $\frac{5}{6} \times \frac{3}{5}$ $\frac{1}{2}$ 104

13. $8 \times \frac{5}{6}$ $6\frac{2}{3}$ $6 \times \frac{3}{4}$ $4\frac{1}{2}$ $\frac{3}{8} \times 10$ $3\frac{3}{4}$ 105

14. $\frac{9}{10} \times \frac{8}{9}$ $\frac{4}{5}$ $\frac{15}{16} \times \frac{4}{9}$ $\frac{5}{12}$ $\frac{5}{6} \times \frac{9}{10}$ $\frac{3}{4}$ 105

15. $\frac{3}{4} \times 2\frac{1}{2}$ $1\frac{7}{8}$ $\frac{1}{6} \times 2\frac{1}{4}$ $\frac{3}{8}$ $2\frac{2}{3} \times 2\frac{1}{4}$ 6 110

Use results of tests as basis for class or individual re-teaching or review. Mastery of these skills should be assured before beginning new work. Help pupils to analyze own errors and determine causes.

See G-68 for specific aims of Chapter 5.

Chapter 5

Hoover Dam

Present problems related to social-studies project (pages 161-162).

For centuries the Colorado River ran wild, cutting into the surface of the earth to form the Grand Canyon, carrying off topsoil, and flooding the valleys near its mouth. To control the Colorado River, our Government built Hoover Dam across the river. This dam prevents floods, provides a continuous supply of water for the crops on a million acres of rich land, and produces electric power.

1. Hoover Dam, which is 726 ft. high, is the highest dam in the United States. To get an idea of the great height of this dam, think of a skyscraper having 56 stories each 13 ft. high. Would such a skyscraper be about 726 ft. high? 728 ft.; yes
2. Shasta Dam in California is 602 ft.(1) high and Hungry Horse Dam in Montana is 564 ft. high.(2) How much higher is Hoover Dam than each of these other dams? (1) 124 ft.; (2) 162 ft.

Point out to pupils that facts in these problems are authentic. Have pupils do problems independently and note how they "attack" them. Let volunteers explain their solutions, giving reasons for process or processes chosen.

Confer with pupils who had mistakes to determine if they are using all problem aids they know, if they are using correct processes, if they are computing incorrectly, if they are reading problems carefully.

Hoover Dam

1. The distance across the top of Hoover Dam is 1244 ft. Is it correct to say that this distance is nearly $\frac{1}{4}$ mi.? Yes How much less than $\frac{1}{4}$ mi. is it? 76 ft.

2. Hoover Dam is made of concrete. The concrete was poured continuously, the work going on day and night, Sundays and holidays, for two years. It took 5,000,000 barrels of cement, each weighing 376 lb., to make the concrete. How many pounds of cement were used in all? 1,880,000,000

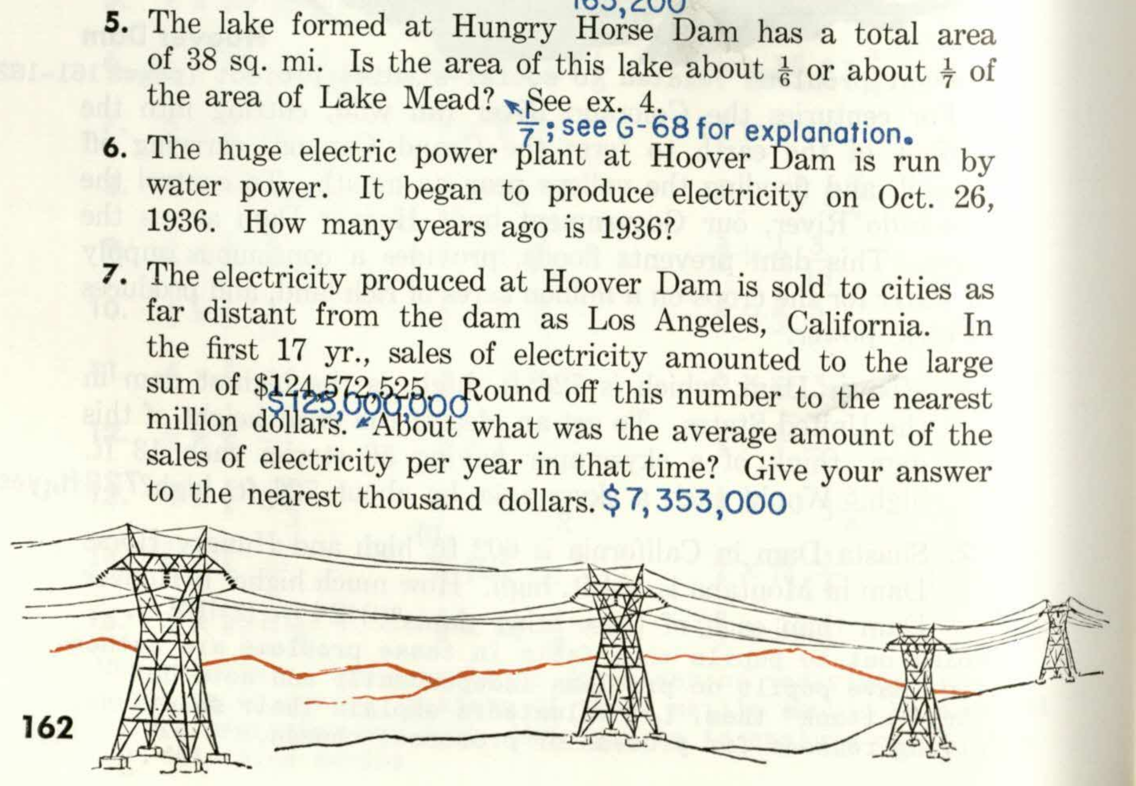
3. On some days as many as 36 railroad cars of cement were used in the construction work. If each car holds 300 barrels of cement, how many barrels were used on these days? 10,800 How many pounds of cement were used on these days? 4,060,800

4. The water of the Colorado River held back by Hoover Dam forms Lake Mead. The water in the lake is 589 ft. deep at the dam. Lake Mead is 120 mi. long, has a shore line of 550 mi., and covers an area of 255 sq. mi. How many acres does Lake Mead cover? 163,200 640 acres = 1 sq. mi.

5. The lake formed at Hungry Horse Dam has a total area of 38 sq. mi. Is the area of this lake about $\frac{1}{6}$ or about $\frac{1}{7}$ of the area of Lake Mead? $\frac{1}{7}$; see G-68 for explanation. See ex. 4.

6. The huge electric power plant at Hoover Dam is run by water power. It began to produce electricity on Oct. 26, 1936. How many years ago is 1936?

7. The electricity produced at Hoover Dam is sold to cities as far distant from the dam as Los Angeles, California. In the first 17 yr., sales of electricity amounted to the large sum of $124,572,525. Round off this number to the nearest million dollars. $125,000,000 About what was the average amount of the sales of electricity per year in that time? Give your answer to the nearest thousand dollars. $7,353,000



Teach the more important tests of divisibility and apply skill to changing fractions with large denominators (pages 163-164).

Tests of Divisibility

The number 245 is said to be **divisible** by 5, because it can be **exactly divided** by 5; the number 247, however, is not divisible by 5. It is often useful to know whether a number is divisible by 2, 3, 5, or 9 without actually dividing the number to find out. The rules below give you some tests of divisibility.
Pupils should memorize rules "after" understanding is assured.

1. **A number is divisible by 5 if it ends in 0 or 5.** 175 and 460 are divisible by 5, but 174 and 461 are not.

2. **A number is divisible by 2 if it ends in 0, 2, 4, 6, or 8.** 348 is divisible by 2 because it ends in 8; but 345 is not divisible by 2 because it ends in 5.

3. A number that is divisible by 2 is called an **even number.** Stress. All even numbers end in 0, 2, 4, 6, or 8. 14, 22, 60, 128, and 1248 are all even numbers.

4. A number that is not divisible by 2 is called an **odd number.** Stress. All odd numbers end in 1, 3, 5, 7, or 9. 17, 69, 113, 429, 631, and 8265 are all odd numbers.

5. **A number is divisible by 3 if the sum of its figures is divisible by 3.** You see that 741 is divisible by 3 since $7 + 4 + 1 = 12$, and 12 is divisible by 3. You also see that 125 is not divisible by 3 because $1 + 2 + 5 = 8$, and 8 is not divisible by 3.

6. **A number is divisible by 9 if the sum of its figures is divisible by 9.** You see that 2817 is divisible by 9 because $2 + 8 + 1 + 7 = 18$, and 18 is divisible by 9. 216 is also divisible by 9. But 4238 is not divisible by 9 because $4 + 2 + 3 + 8 = 17$, and 17 is not divisible by 9.

In ex. 7-9 have pupils tell which rules apply and "why."

Which of these numbers are divisible by 2? by 3? by 5? by 9? Use the rules above to find out: Do ex. 7 with pupils. If there are no difficulties, have them complete ex. 8-9 independently.

7. 176 2 531 3,9 170 2,5 633 3 192 2,3 2520 2,3,5,9 3474 2,3,9

8. 315 3,5,9 162 2,3,9 603 3,9 426 2,3 354 2,3 4228 2 5085 3,5,9

9. 241 236 2 219 3 747 3,9 504 2,3,9 5346 2,3,9 2790 2,3,5,9

Emphasize that test of divisibility is merely short way of finding whether a number is divisible by 2, 3, 5, or 9 without actually dividing the number. Be sure terms "even number" and "odd number" are well understood.

Using Tests of Divisibility

1. Problem An airplane traveled 486 mi. in 72 min. Find the average speed of the plane in miles per minute. $6\frac{3}{4}$

Explanation The average speed of the plane was $6\frac{54}{72}$ mi. per minute. In cases like this, change the fraction to lowest terms. Use the tests of divisibility on page 163 to help you find a number that will exactly divide both 54 and 72.

$$6\frac{54}{72} = 6\frac{3}{4}$$

$$\begin{array}{r} 72\overline{)486} \\ 432 \\ \hline 54 \end{array}$$

You see that both terms of $\frac{54}{72}$ are divisible by 2 because they are both even numbers. Dividing both terms by 2, you get $\frac{27}{36}$. How do you know that both terms of $\frac{27}{36}$ are not divisible by 2? How do you know that both terms of $\frac{27}{36}$ are divisible by 9? Are 27 and 36 both divisible by any other number? Can you see why it is better to divide by 9 than by 3?

$$\frac{\overset{\overset{3}{\cancel{27}}}{\cancel{54}}}{\underset{\underset{4}{\cancel{36}}}{\cancel{72}}} = \frac{3}{4}$$

2. What part of a mile is 660 ft.? $\frac{1}{8}$ 880 ft.? $\frac{1}{6}$ 3960 ft.? $\frac{3}{4}$

▶ 660 ft. is $\frac{660}{5280}$ of a mile. Change $\frac{660}{5280}$ to lowest terms.

3. What part of an hour is 45 min.? $\frac{3}{4}$ 40 min.? $\frac{2}{3}$ 18 min.? $\frac{3}{10}$

4. A train traveled 984 mi. at an average speed of 60 mi. per hour. How many hours did the train take to make the trip of 984 mi.? $16\frac{2}{5}$

In ex. 5–9 have pupils note tests they used.

Change to lowest terms. Use the tests on page 163:

5. $\frac{42}{84}$ $\frac{1}{2}$ $\frac{64}{96}$ $\frac{2}{3}$ $\frac{35}{50}$ $\frac{7}{10}$ $\frac{60}{75}$ $\frac{4}{5}$ $\frac{48}{144}$ $\frac{1}{3}$ $\frac{100}{125}$ $\frac{4}{5}$ $\frac{180}{252}$ $\frac{5}{7}$ $\frac{270}{315}$ $\frac{6}{7}$

6. $\frac{50}{75}$ $\frac{2}{3}$ $\frac{45}{60}$ $\frac{3}{4}$ $\frac{54}{72}$ $\frac{3}{4}$ $\frac{40}{64}$ $\frac{5}{8}$ $\frac{102}{420}$ $\frac{17}{70}$ $\frac{150}{180}$ $\frac{5}{6}$ $\frac{135}{225}$ $\frac{3}{5}$ $\frac{45}{120}$ $\frac{3}{8}$

7. $\frac{54}{90}$ $\frac{3}{5}$ $\frac{60}{96}$ $\frac{5}{8}$ $\frac{30}{78}$ $\frac{5}{13}$ $\frac{21}{56}$ $\frac{3}{8}$ $\frac{72}{120}$ $\frac{3}{5}$ $\frac{120}{375}$ $\frac{8}{25}$ $\frac{216}{360}$ $\frac{3}{5}$ $\frac{104}{312}$ $\frac{1}{3}$

8. $\frac{32}{80}$ $\frac{2}{5}$ $\frac{45}{75}$ $\frac{3}{5}$ $\frac{56}{60}$ $\frac{14}{15}$ $\frac{18}{48}$ $\frac{3}{8}$ $\frac{216}{288}$ $\frac{3}{4}$ $\frac{72}{117}$ $\frac{8}{13}$ $\frac{75}{120}$ $\frac{5}{8}$ $\frac{105}{175}$ $\frac{3}{5}$

9. $\frac{40}{48}$ $\frac{5}{6}$ $\frac{48}{60}$ $\frac{4}{5}$ $\frac{40}{96}$ $\frac{5}{12}$ $\frac{48}{88}$ $\frac{6}{11}$ $\frac{78}{195}$ $\frac{2}{5}$ $\frac{90}{144}$ $\frac{5}{8}$ $\frac{45}{315}$ $\frac{1}{7}$ $\frac{108}{180}$ $\frac{3}{5}$

More Practice. See ㉗ on page 318. Use to reinforce skill.

Do ex. 1–4 with pupils, following ex. 1 procedure. Then have pupils do ex. 5–6 independently. Check to see that all are able to use divisibility tests. Have pupils then complete ex. 7–9. Let volunteers explain their solutions.

Teach long division with 3-figure divisors where Rule I (divisors ending in 1, 2, 3, 4, or 5) is used.

Three-Figure Divisors

1. **Problem** Mr. Page drove his automobile 9114 mi. in 217 da. Find the number of miles, on the average, that he drove per day during this period. 42

Explanation You need to divide 9114 by 217. Use the same five steps that you have been using with 2-figure divisors. Stress.

Divide 911 by 217. Think, "There are four 2's in 9." Write 4 in the quotient over the last figure of 911. **Multiply** 217 by 4, which gives 868. **Subtract** 868 from 911, which leaves 43. **Compare** 43 with 217 to see that it is smaller. **Bring down** 4, making the next partial dividend 434. Emphasize that 434 is 434 "ones."

$$\begin{array}{r} 42 \\ 217\overline{)9114} \\ \underline{868} \\ 434 \\ \underline{434} \end{array}$$

Repeat these five steps to get the second quotient figure. **Divide** 434 by 217. First think, "4 ÷ 2 = 2." Tell how to finish the work.

The quotient is 42. Check the work by multiplying 217 by 42. Mr. Page drove an average of 42 mi. per day.

Check

$$\begin{array}{r} 217 \\ \underline{42} \\ 434 \\ \underline{868} \\ 9114 \end{array}$$

Emphasize Rule I.

When the second figure of the divisor is 1, 2, 3, 4, or 5, divide by the first figure of the divisor to estimate the quotient figure.

Do ex. 2 with pupils, following ex. 1 procedure. Then have them complete ex. 3–5.

Divide and check. Write R before any remainder:

2.	$\begin{array}{r}5\\234\overline{)1170}\end{array}$	$\begin{array}{r}5R8\\318\overline{)1598}\end{array}$	$\begin{array}{r}31\\321\overline{)9951}\end{array}$	$\begin{array}{r}24\\512\overline{)12288}\end{array}$
3.	$\begin{array}{r}6\\427\overline{)2562}\end{array}$	$\begin{array}{r}4R47\\342\overline{)1415}\end{array}$	$\begin{array}{r}37\\214\overline{)7918}\end{array}$	$\begin{array}{r}27\\641\overline{)17307}\end{array}$
4.	$\begin{array}{r}4R14\\719\overline{)2890}\end{array}$	$\begin{array}{r}9\\438\overline{)3942}\end{array}$	$\begin{array}{r}26\\316\overline{)8216}\end{array}$	$\begin{array}{r}36\\543\overline{)19548}\end{array}$
5.	$\begin{array}{r}4R11\\350\overline{)1411}\end{array}$	$\begin{array}{r}5\\623\overline{)3115}\end{array}$	$\begin{array}{r}15\\412\overline{)6180}\end{array}$	$\begin{array}{r}32\\329\overline{)10528}\end{array}$

More Practice. See ㉘ on page 319. Use to reinforce skill.

In discussing ex. 1 with pupils, be sure they understand why "4" in quotient is written over "1" in dividend (since 911 "tens" were divided). Emphasize comparison step and reason "why" remainder must be smaller than divisor.

Three-Figure Divisors

1. Problem Jim and his family are planning a trip of 1845 mi. during their vacation. If they drive an average of 315 mi. each day, how many days will the trip take? $5\frac{6}{7}$

Explanation You need to divide 1845 by 315. To estimate the quotient figure you think, "There are six 3's in 18." When you multiply 315 by 6 you get 1890, which is too large to be subtracted from 1845. When you try 5 for the quotient figure, you get a remainder of 270. Why is 5 correct? Check by multiplying 315 by 5 and adding 270. Explain how to change the fraction in the quotient to lowest terms.

$$\begin{array}{r} 5\frac{270}{315} = 5\frac{6}{7} \\ 315\overline{)1845} \\ \underline{1575} \\ 270 \end{array}$$

The quotient is $5\frac{6}{7}$. The trip will take $5\frac{6}{7}$ da.

Have volunteers explain work in ex. 2-8 at blackboard.

Divide and check. Write R before each remainder:

2. $\overset{52}{347\overline{)18044}}$ $\overset{32\text{ R}12}{321\overline{)10284}}$ $\overset{275}{423\overline{)116325}}$

3. $\overset{62}{437\overline{)27094}}$ $\overset{65\text{ R}87}{542\overline{)35317}}$ $\overset{587}{242\overline{)142054}}$

4. $\overset{48}{734\overline{)35232}}$ $\overset{72\text{ R}102}{435\overline{)31422}}$ $\overset{319}{541\overline{)172579}}$

5. $\overset{94\text{ R}171}{237\overline{)22449}}$ $\overset{52\text{ R}7}{621\overline{)32299}}$ $\overset{372\text{ R}532}{643\overline{)239728}}$

Emphasize use of divisibility tests in changing fractions in quotients.

Divide and check. When there is a remainder, write the quotient with a fraction. Change the fraction to lowest terms:

6. $\overset{72\frac{1}{9}}{225\overline{)16225}}$ $\overset{64}{429\overline{)27456}}$ $\overset{221\frac{4}{91}}{819\overline{)181035}}$

7. $\overset{75}{741\overline{)55575}}$ $\overset{48\frac{3}{35}}{315\overline{)15147}}$ $\overset{367\frac{1}{13}}{624\overline{)229056}}$

8. $\overset{58\frac{9}{29}}{406\overline{)23674}}$ $\overset{46}{812\overline{)37352}}$ $\overset{974\frac{2}{9}}{243\overline{)236736}}$

More Practice. See ㉙ on page 319. ↙ Use for individual pupil assistance.

Discuss ex. 1 carefully with pupils. Remind them of tests of divisibility as help in changing fraction in remainder. If there are no questions, assign ex. 2-8 as independent work. Observe pupils to note any difficulties and give assistance.

Present set of improvement tests in addition.
Review important arithmetical terms.

Improving by Practice

Addition Test 3a. Time: 4 min.

1.	$22.17	$30.07	$15.89	$26.69	$32.49	
	4.82	87.57	16.22	8.74	4.56	
	34.53	36.86	9.68	43.57	44.77	
	22.48	28.50	7.47	23.96	15.76	
	5.74	34.69	19.44	2.53	10.32	⑤
	$89.74	$217.69	$68.70	$105.49	$107.90	

Addition Test 3b. Time: 4 min.

2.	$10.32	$32.40	$25.16	$37.02	$99.76	
	2.81	53.85	9.67	35.89	4.34	
	96.91	7.64	39.45	12.99	64.47	
	5.69	23.95	6.57	18.65	6.68	
	74.53	3.45	14.38	25.99	80.89	⑤
	$190.26	$121.29	$95.23	$130.54	$256.14	

Addition Test 3c. Time: 4 min.

3.	$15.58	$45.76	$51.75	$58.14	$43.94	
	19.93	78.87	6.86	7.97	6.68	
	98.12	9.73	35.93	18.28	30.69	
	49.51	30.48	96.67	84.09	12.84	
	21.09	8.40	6.77	5.96	31.45	⑤
	$204.23	$173.24	$197.98	$174.44	$125.60	

The Language of Arithmetic

Do ex. 4-21 as oral activity.

Show that you know what each word or group of words means by using it in a sentence or by giving an example of it:

4. gallon
5. less than
6. estimate
7. rectangle
8. bar graph
9. dividend
10. divisible
11. thousand
12. multiplier
13. factor
14. difference
15. numerator
16. remainder
17. denominator
18. square yard
19. round number
20. multiplicand
21. nearest million

Tests should be given, scored, and recorded as others were (see pages 54-58). Have volunteers explain their work at board so pupils may correct their mistakes. Pupils who are unsure of terms in ex. 4-21 should make study cards (see page 99) for own use.

Teach long division with 3-figure divisors where Rule II applies.

Three-Figure Divisors

1. **Problem** Mr. Hall kept a record of all the eggs his hens laid last year. There were 249,017 eggs in all. How many eggs did Mr. Hall's hens lay, on the average, per day? 682

$$\begin{array}{r} 682 \\ 365\overline{)249017} \\ 2190 \\ \hline 3001 \\ 2920 \\ \hline 817 \\ 730 \\ \hline 87 \end{array}$$

Explanation You need to divide 249,017 by 365, the number of days in a year.

Since the second figure of 365 is 6, divide by 4, instead of 3, to estimate each quotient figure. You divide by 4 because 365 is nearer 400 than it is to 300. Think, "24 ÷ 4 = 6." Multiply 365 by 6 and subtract the result from 2490. This leaves 300, which is less than 365.

To find the second quotient figure, divide 30 by 4, which gives 7. Multiply 365 by 7 and subtract the result from 3001. This leaves 446, which is **larger** than 365. This shows that 7 is **too small** for the quotient figure. Try 8. Why is 8 right?

Explain how to find the third quotient figure.

The quotient is 682 with a remainder of 87. Mr. Hall's hens laid, on the average, about 682 eggs per day. How do you check the work?

Emphasize Rule II.

When the second figure of the divisor is 6, 7, 8, or 9, divide by 1 more than the first figure of the divisor to estimate the quotient figure.

Do ex. 2 with pupils and have volunteers explain work at board.
Assign ex. 3-4 as independent work.

Divide and check. Write R before any remainder:

2. $283\overline{)10471}$ 37 $277\overline{)90025}$ 325 $692\overline{)357764}$ 517

3. $578\overline{)26739}$ 46R151 $188\overline{)49711}$ 264R79 $297\overline{)174042}$ 586

4. $763\overline{)13734}$ 18 $286\overline{)78743}$ 275R93 $383\overline{)238992}$ 624

More Practice. See ㉚ on page 319. Use to reinforce skill.

It might be well to review Rule II with 2-figure divisors first (see page 32). In discussing ex. 1 emphasize proper placement of quotient figures and reasons for placement (dividing hundreds gives hundreds, and so on).

Present certain zero difficulties in division with 3-figure divisors. Ex. 1–5 may be done as class activity. If there are no questions, have pupils complete ex. 6–10.

Watch the Zeros

1. Study the examples below. Then copy them without the work and do them yourself:

$$\begin{array}{r} 207 \\ 328\overline{)67896} \\ \underline{656} \\ 2296 \\ \underline{2296} \end{array} \qquad \begin{array}{r} \$5.70 \\ 612\overline{)\$3488.40} \\ \underline{3060} \\ 428\;4 \\ \underline{428\;4} \\ 0 \end{array} \qquad \begin{array}{r} 4006 \\ 283\overline{)1133841} \\ \underline{1132} \\ 1841 \\ \underline{1698} \\ 143 \end{array}$$

2. Henry's father uses their car in his business. Last year the car was driven a total of 29,200 miles. How many miles was the car driven, on the average, per day? 80

3. This year 226 new books were added to the library of the Lincoln School. They cost \$698.34. What was the average cost per book? \$3.09

4. Mr. Wood wanted to find the average weight of 14-year-old boys in the Middletown schools. There were 243 boys who were 14 yr. old. Mr. Wood found the sum of their weights to be 26,259 lb. What was the average weight of these boys? About 108 lb.

5. Mr. Johnson drove the school bus 7615 mi. last year. He said that he had driven the bus on 193 da. all together. What was the average number of miles per school day that Mr. Johnson drove the bus? About 39

Divide and check. When there is a remainder write the quotient with a fraction and change the fraction to lowest terms:

6. $\begin{array}{r} 60 \\ 279\overline{)16740} \end{array}$ $\quad\begin{array}{r} 40\frac{3}{32} \\ 512\overline{)20528} \end{array}$ $\quad\begin{array}{r} 207\frac{1}{2} \\ 732\overline{)151890} \end{array}$ $\quad\begin{array}{r} 306 \\ 396\overline{)121176} \end{array}$

7. $\begin{array}{r} 27\frac{9}{47} \\ 423\overline{)11502} \end{array}$ $\quad\begin{array}{r} 50 \\ 682\overline{)34100} \end{array}$ $\quad\begin{array}{r} 270\frac{2}{23} \\ 184\overline{)49696} \end{array}$ $\quad\begin{array}{r} 503 \\ 215\overline{)108145} \end{array}$

8. $\begin{array}{r} 8365 \\ 409\overline{)3421285} \end{array}$ $\quad\begin{array}{r} 2050 \\ 688\overline{)1410400} \end{array}$ $\quad\begin{array}{r} \$\;\;5.40\frac{1}{8} \\ 288\overline{)\$1555.56} \end{array}$

9. $\begin{array}{r} 9982 \\ 175\overline{)1746850} \end{array}$ $\quad\begin{array}{r} 6002 \\ 573\overline{)3439146} \end{array}$ $\quad\begin{array}{r} \$\;\;6.74 \\ 721\overline{)\$4859.54} \end{array}$

10. $\begin{array}{r} 5263\frac{1}{3} \\ 840\overline{)4421200} \end{array}$ $\quad\begin{array}{r} 8040 \\ 919\overline{)7388760} \end{array}$ $\quad\begin{array}{r} \$\;\;7.45\frac{1}{13} \\ 975\overline{)\$7264.50} \end{array}$

Put model examples in ex. 1 on board and discuss them step by step with pupils. Be sure they know "why" zero is needed in quotients (to show that tens, and so on, have been divided).

Present complete review of all fraction skills taught thus far.

Review of Fractions

1. The Camera Club is going to have a picnic next Saturday. Peter has to buy the chopped meat to cook over a fire. He will allow $\frac{1}{4}$ lb. of meat for each person. How many pounds of meat should he buy for 28 persons? 7 for 23 persons? $5\frac{3}{4}$ for 25 persons? $6\frac{1}{4}$

2. If Peter buys $5\frac{3}{4}$ lb. of chopped meat at \$.45 a pound, how much will the bill for meat be? \$2.59

3. The picnic will be at Mirror Lake or at Long Lake. It is $5\frac{1}{4}$ mi. to Mirror Lake and $3\frac{1}{2}$ mi. to Long Lake. How much farther is it to Mirror Lake than to Long Lake? $1\frac{3}{4}$ mi.

Add and check:

4.	$5\frac{3}{16}$	$5\frac{2}{3}$	$2\frac{1}{2}$	$7\frac{3}{4}$	$2\frac{7}{10}$	$4\frac{1}{2}$	$9\frac{1}{3}$
	$8\frac{7}{16}$	$2\frac{5}{6}$	$2\frac{1}{3}$	$2\frac{5}{6}$	$1\frac{3}{5}$	$6\frac{5}{8}$	$5\frac{5}{12}$
	$13\frac{5}{8}$	$8\frac{1}{2}$	$4\frac{5}{6}$	$10\frac{7}{12}$	$4\frac{3}{10}$	$11\frac{1}{8}$	$14\frac{3}{4}$

Subtract and check:

5.	$6\frac{9}{10}$	$5\frac{1}{2}$	$9\frac{5}{6}$	$7\frac{3}{8}$	$7\frac{1}{12}$	$3\frac{5}{6}$	$8\frac{3}{4}$
	$4\frac{3}{10}$	$3\frac{1}{5}$	$4\frac{1}{8}$	$6\frac{3}{4}$	$2\frac{5}{6}$	$2\frac{1}{2}$	$5\frac{5}{16}$
	$2\frac{3}{5}$	$2\frac{3}{10}$	$5\frac{17}{24}$	$\frac{5}{8}$	$4\frac{1}{4}$	$1\frac{1}{3}$	$3\frac{7}{16}$

Multiply and check:

6. $9 \times \frac{2}{3}$ 6 $\frac{3}{4} \times \frac{1}{2}$ $\frac{3}{8}$ $\frac{1}{3} \times \frac{1}{2}$ $\frac{1}{6}$ $\frac{3}{8} \times 2\frac{2}{3}$ 1 $3\frac{1}{2} \times 3\frac{1}{4}$ $11\frac{3}{8}$

7. $\frac{1}{2} \times \frac{3}{8}$ $\frac{3}{16}$ $\frac{1}{2} \times \frac{1}{2}$ $\frac{1}{4}$ $\frac{7}{8} \times \frac{2}{3}$ $\frac{7}{12}$ $3 \times 1\frac{1}{6}$ $3\frac{1}{2}$ $2\frac{3}{4} \times 12$ 33

8. $\frac{3}{4} \times 7$ $5\frac{1}{4}$ $\frac{4}{5} \times \frac{3}{8}$ $\frac{3}{10}$ $8 \times \frac{5}{6}$ $6\frac{2}{3}$ $\frac{5}{8} \times 4\frac{4}{5}$ 3 $15 \times 1\frac{1}{4}$ $18\frac{3}{4}$

9. $\frac{1}{3} \times \frac{3}{4}$ $\frac{1}{4}$ $\frac{7}{8} \times 6$ $5\frac{1}{4}$ $\frac{5}{12} \times \frac{3}{10}$ $\frac{1}{8}$ $\frac{3}{16} \times 2\frac{2}{3}$ $\frac{1}{2}$ $5\frac{1}{4} \times 3\frac{1}{3}$ $17\frac{1}{2}$

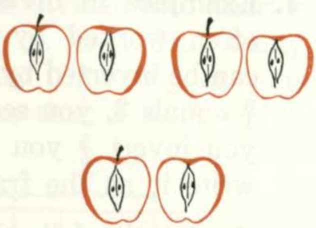
10. $5 \times \frac{1}{2}$ $2\frac{1}{2}$ $4 \times \frac{1}{8}$ $\frac{1}{2}$ $\frac{3}{10} \times 8$ $2\frac{2}{5}$ $\frac{4}{5} \times 4\frac{3}{8}$ $3\frac{1}{2}$ $6\frac{2}{3} \times \frac{9}{10}$ 6

11. $7 \times \frac{2}{5}$ $2\frac{4}{5}$ $\frac{4}{5} \times 3$ $2\frac{2}{5}$ $\frac{15}{16} \times \frac{1}{10}$ $\frac{3}{32}$ $\frac{2}{3} \times 1\frac{1}{8}$ $\frac{3}{4}$ $3\frac{3}{8} \times 5\frac{1}{3}$ 18

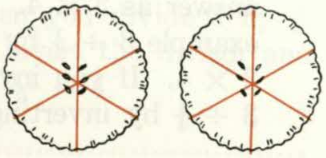
These skills must be mastered before pupils begin new work in division of fractions. Stop now and plan for reteaching or review based on class or individual needs.

Provide practice experiences in dividing whole numbers by fractions (pages 171-173). Emphasize that answers are "halves," "sixths," and so on.

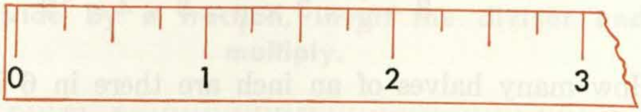
Dividing by a Fraction



1. On the right there are 3 apples each cut into halves. How many halves are there in 3 apples? Here is another way to write this question: $3 \div \frac{1}{2} = ?$ You see that the answer to $3 \div \frac{1}{2}$ is 6, which is the same as the answer to 3×2.



2. Here are 2 pies cut into sixths. How many sixths are there in 2 pies? You can write this question as a division example like this: $2 \div \frac{1}{6} = ?$ The answer to $2 \div \frac{1}{6}$ is 12, which is the same as the answer to 2×6.



3. The drawing above shows 3 in. of a foot ruler. Each inch is divided into fourths of an inch. How many fourths of an inch are there in 3 in.? Since there are 4 fourths in 1 in., there are 3×4 fourths, or 12 fourths, in 3 in. This shows that $3 \div \frac{1}{4} = 12$. You see that the answer to $3 \div \frac{1}{4}$ is the same as the answer to 3×4.

4. How many halves are there in 4 apples? 8 Make a drawing of 4 apples cut into halves to help you find the answer. Also write the question as a division example with its answer. $4 \div \frac{1}{2} = 8$ See ex. 1.

5. How many fourths of an inch are there in 5 in.? 20 Make a drawing to show the answer. Also write the question as a division example. $5 \div \frac{1}{4} = 20$

6. Judy and her mother baked 3 pies for Judy's birthday party. How many pieces of pie will there be if the pies are cut into sixths? 18 into eighths? 24 into fifths? 15 If you need help to find these answers, draw pies and divide them into equal pieces.

Give pupils opportunity to follow development in ex. 1-6 by using fractional cutouts and diagrams or pictures. Also use subtractive approach by having pupils find out how many times $\frac{1}{2}$ can be subtracted from 3, $\frac{1}{6}$ from 2, and so on.

Help pupils "discover" rule for inverting divisor. Give few more problems like those on page 171 and have pupils find answers by drawings, repeated subtractions, measuring (if necessary).

Inverting the Divisor

1. Examples in division which have fractions as divisors are often worked by **inverting the divisor.** The divisor $\frac{1}{3}$ can be inverted by turning it upside down like this: $\frac{3}{1}$. Since $\frac{3}{1}$ equals 3, you see that $\frac{1}{3}$ becomes 3 when inverted. When you invert $\frac{5}{6}$ you get $\frac{6}{5}$. To invert the number 4 you first write it as the fraction $\frac{4}{1}$; inverting $\frac{4}{1}$ you get $\frac{1}{4}$.

2. Invert the following: $\frac{1}{4}$, $\frac{4}{1}$ $\frac{2}{3}$, $\frac{3}{2}$ $\frac{5}{4}$, $\frac{4}{5}$ $\frac{6}{1}$, $\frac{1}{6}$ $\frac{3}{4}$, $\frac{4}{3}$ 5, $\frac{1}{5}$ $\frac{9}{8}$. $\frac{8}{9}$

3. In ex. 3 on page 171 you found that $3 \div \frac{1}{4}$ has the same answer as 3×4. This means that you can do the division example $3 \div \frac{1}{4}$ by turning it into the multiplication example 3×4. If you invert $\frac{1}{4}$, you get 4. So you do the work for $3 \div \frac{1}{4}$ by inverting the divisor $\frac{1}{4}$ and multiplying, like this:

$$3 \div \frac{1}{4} = 3 \times \frac{4}{1} = 3 \times 4 = 12$$

4. How many halves of an inch are there in 6 in.? 12 You can write this question as a division example like this: $6 \div \frac{1}{2} = ?$ 12 Show how to turn this division example into a multiplication example by inverting the divisor. $6 \times \frac{2}{1} = 12$ (halves of an inch)

5. How many eighths of a yard are there in 4 yd.? 32 Write this question as a division example and then invert the divisor and multiply to find the answer. $4 \div \frac{1}{8} = 4 \times \frac{8}{1} = 32$ (eighths of a yard)

6. How many fourths of a pound are there in 12 lb.?
$12 \div \frac{1}{4} = 12 \times \frac{4}{1} = 48$ (fourths of a pound)

Find the answers. Invert the divisor and multiply:

7. $6 \div \frac{1}{3}$ 18 $8 \div \frac{1}{2}$ 16 $2 \div \frac{1}{8}$ 16 $3 \div \frac{1}{3}$ 9 $12 \div \frac{1}{2}$ 24

8. $4 \div \frac{1}{5}$ 20 $9 \div \frac{1}{4}$ 36 $7 \div \frac{1}{6}$ 42 $6 \div \frac{1}{4}$ 24 $15 \div \frac{1}{3}$ 45

9. $8 \div \frac{1}{3}$ 24 $5 \div \frac{1}{2}$ 10 $7 \div \frac{1}{4}$ 28 $3 \div \frac{1}{8}$ 24 $16 \div \frac{1}{2}$ 32

10. $5 \div \frac{1}{6}$ 30 $4 \div \frac{1}{6}$ 24 $9 \div \frac{1}{2}$ 18 $2 \div \frac{1}{5}$ 10 $12 \div \frac{1}{3}$ 36

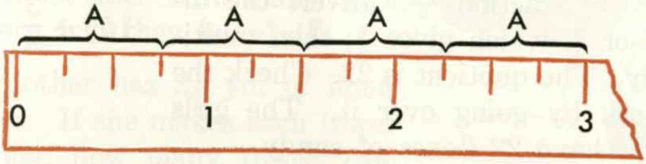
11. $2 \div \frac{1}{3}$ 6 $5 \div \frac{1}{4}$ 20 $8 \div \frac{1}{6}$ 48 $6 \div \frac{1}{2}$ 12 $10 \div \frac{1}{4}$ 40

Follow development as given. Lead pupils to state rule in own words. Emphasize that answers are in terms of halves, thirds, and so on, to develop understanding of why quotients are larger in division by fractions than by whole numbers.

Present rule for dividing by fraction. Discuss ex. 1–4 carefully with pupils. Assign ex. 5–7 as independent work if there are no difficulties.

Dividing by a Fraction

1. The drawing below shows 3 in. of a ruler divided into quarter inches. The parts marked A are each $\frac{3}{4}$ in. long. How many parts like A are there? 4 Then how many times is $\frac{3}{4}$ in. contained in 3 in.? 4 Write the question like this: $3 \div \frac{3}{4} = ?$ 4



2. Ex. 1 shows that the answer is 4 when you divide 3 by $\frac{3}{4}$. A quick way to get this answer is to invert the divisor and multiply like this: $3 \div \frac{3}{4} = \frac{3}{1} \times \frac{4}{3} = \frac{12}{3} = 4$.

Emphasize after discovery.

To divide by a fraction, invert the divisor and multiply.

3. Here is another way to show that $3 \div \frac{3}{4} = 4$. Change 3 to $\frac{12}{4}$. Then divide $\frac{12}{4}$ by $\frac{3}{4}$; to do this think, "12 **fourths** $\div$ 3 **fourths** $= 12 \div 3$, or 4, just as 12 **boys** $\div$ 3 **boys** $= 4$."

Use method of ex. 3 to solve few more examples.

4. When you divide by a fraction you can often shorten the work by cancellation, as shown below:

$$6 \div \frac{4}{5} = \frac{6}{1} \times \frac{5}{4} = \frac{\overset{3}{\cancel{6}}}{1} \times \frac{5}{\underset{2}{\cancel{4}}} = \frac{15}{2} = 7\frac{1}{2}$$

Divide. Cancel when you can:

5. $4 \div \frac{4}{5}$ 5 $6 \div \frac{5}{8}$ $9\frac{3}{5}$ $3 \div \frac{5}{6}$ $3\frac{3}{5}$ $12 \div \frac{3}{4}$ 16 $15 \div \frac{5}{16}$ 48

6. $5 \div \frac{3}{4}$ $6\frac{2}{3}$ $6 \div \frac{5}{6}$ $7\frac{1}{5}$ $8 \div \frac{4}{5}$ 10 $21 \div \frac{7}{8}$ 24 $18 \div \frac{9}{10}$ 20

7. $4 \div \frac{2}{3}$ 6 $8 \div \frac{3}{4}$ $10\frac{2}{3}$ $9 \div \frac{2}{3}$ $13\frac{1}{2}$ $12 \div \frac{3}{8}$ 32 $15 \div \frac{9}{10}$ $16\frac{2}{3}$

More Practice. See ㉛ on page 320. Use for individual assistance.

Develop further understanding that quotients are sensible by referring to subtractive aspect of division: for example, $4 \div \frac{4}{5}$ means that a number less than 1 is subtracted from 4. Answer must be more than 4, therefore 5 is sensible.

Dividing by a Fraction

Teach division of mixed number or fraction by fraction (pages 174–175). Review fact that in multiplying by mixed numbers, it was necessary to change them to improper fractions. Then follow development as given.

1. Problem Some girls have made $16\frac{1}{2}$ lb. of candy for the school fair. They want to put it in boxes holding $\frac{3}{4}$ lb. each. How many boxes of candy will they have? 22

Explanation Change $16\frac{1}{2}$ to the improper fraction $\frac{33}{2}$. Invert the divisor $\frac{3}{4}$, which gives $\frac{4}{3}$; then multiply. The quotient is 22. Check the work by going over it. The girls will have 22 boxes of candy.

$$16\frac{1}{2} \div \frac{3}{4} = \frac{\overset{11}{\cancel{33}}}{\underset{1}{\cancel{2}}} \times \frac{\overset{2}{\cancel{4}}}{\underset{1}{\cancel{3}}} = 22$$

2. Judy did ex. 1 another way. She changed $16\frac{1}{2}$ lb. to 264 oz. and $\frac{3}{4}$ lb. to 12 oz. Then she divided 264 oz. by 12 oz., as shown at the right. Her answer was 22, which is the same as the answer found in ex. 1. The way the problem is worked in ex. 1 is usually the best way to work a problem of this kind.

$16\frac{1}{2}$ lb. = $16\frac{1}{2} \times 16$ oz. = 264 oz.
$\frac{3}{4}$ lb. = $\frac{3}{4} \times 16$ oz. = 12 oz.
264 oz. ÷ 12 oz. = 22

3. Fractions are divided by fractions just as mixed numbers are divided by fractions. In either case, invert the divisor and multiply. For example, to divide $\frac{5}{6}$ by $\frac{2}{3}$, do the work as shown at the right.

$$\frac{5}{6} \div \frac{2}{3} = \frac{5}{\underset{2}{\cancel{6}}} \times \frac{\overset{1}{\cancel{3}}}{2} = \frac{5}{4} = 1\frac{1}{4}$$

Be sure pupils invert the divisor.

Divide. Check the work by going over it:

4. $2\frac{2}{3} \div \frac{1}{6}$ 16 $2\frac{1}{2} \div \frac{2}{5}$ $6\frac{1}{4}$ $\frac{3}{4} \div \frac{1}{3}$ $2\frac{1}{4}$

5. $1\frac{1}{8} \div \frac{3}{4}$ $1\frac{1}{2}$ $2\frac{2}{3} \div \frac{1}{2}$ $5\frac{1}{3}$ $\frac{1}{4} \div \frac{1}{8}$ 2

6. $6\frac{2}{3} \div \frac{5}{6}$ 8 $1\frac{1}{4} \div \frac{5}{6}$ $1\frac{1}{2}$ $\frac{5}{6} \div \frac{1}{8}$ $6\frac{2}{3}$

7. $5\frac{1}{2} \div \frac{2}{3}$ $8\frac{1}{4}$ $1\frac{7}{8} \div \frac{3}{4}$ $2\frac{1}{2}$ $\frac{2}{3} \div \frac{1}{8}$ $5\frac{1}{3}$

8. $3\frac{3}{5} \div \frac{4}{5}$ $4\frac{1}{2}$ $6\frac{1}{4} \div \frac{5}{6}$ $7\frac{1}{2}$ $\frac{1}{2} \div \frac{3}{4}$ $\frac{2}{3}$

More Practice. See ㉜ on page 320.

Emphasize that quotient must be changed back to mixed number and any fractional amount changed to lowest terms.

Problems and Practice

1. Paul and Fred popped 5 big bowls of popcorn. It weighed $4\frac{1}{2}$ lb. when popped. They want to put it in bags holding $\frac{1}{4}$ lb. each and take it to the school sale. How many bags of popcorn will they have? 18

2. Sally's mother has $2\frac{1}{4}$ yd. of linen for towels. If she makes each towel $\frac{3}{4}$ yd. long, how many towels can she make from $2\frac{1}{4}$ yd.? 3

3. Mr. Wood has $7\frac{1}{2}$ lb. of maple candy. He wants to put it in boxes holding $\frac{3}{8}$ lb. each. How many boxes can he fill with maple candy? 20

Divide. Cancel when possible. Check the work by going over it:

4. $2\frac{2}{3} \div \frac{2}{3}$ 4 $2\frac{1}{4} \div \frac{3}{8}$ 6 $\frac{9}{16} \div \frac{1}{4}$ $2\frac{1}{4}$ $\frac{5}{8} \div \frac{3}{4}$ $\frac{5}{6}$ $\frac{1}{2} \div \frac{1}{8}$ 4

5. $3\frac{1}{3} \div \frac{3}{8}$ $8\frac{8}{9}$ $4\frac{2}{3} \div \frac{7}{8}$ $5\frac{1}{3}$ $\frac{15}{16} \div \frac{5}{8}$ $1\frac{1}{2}$ $\frac{3}{8} \div \frac{5}{6}$ $\frac{9}{20}$ $\frac{5}{6} \div \frac{1}{2}$ $1\frac{2}{3}$

6. $2\frac{1}{3} \div \frac{1}{8}$ $18\frac{2}{3}$ $2\frac{2}{5} \div \frac{3}{5}$ 4 $\frac{5}{16} \div \frac{1}{4}$ $1\frac{1}{4}$ $\frac{5}{6} \div \frac{2}{3}$ $1\frac{1}{4}$ $\frac{3}{8} \div \frac{1}{2}$ $\frac{3}{4}$

7. $6\frac{3}{4} \div \frac{3}{8}$ 18 $7\frac{1}{2} \div \frac{5}{8}$ 12 $\frac{5}{12} \div \frac{1}{6}$ $2\frac{1}{2}$ $\frac{2}{3} \div \frac{1}{6}$ 4 $\frac{5}{6} \div \frac{5}{8}$ $1\frac{1}{3}$

8. $5\frac{1}{4} \div \frac{7}{8}$ 6 $7\frac{1}{2} \div \frac{3}{5}$ $12\frac{1}{2}$ $\frac{11}{16} \div \frac{3}{4}$ $\frac{11}{12}$ $\frac{1}{2} \div \frac{1}{5}$ $2\frac{1}{2}$ $\frac{3}{4} \div \frac{5}{8}$ $1\frac{1}{5}$

9. $1\frac{1}{8} \div \frac{3}{4}$ $1\frac{1}{2}$ $6\frac{1}{4} \div \frac{3}{8}$ $16\frac{2}{3}$ $\frac{1}{12} \div \frac{2}{3}$ $\frac{1}{8}$ $\frac{3}{4} \div \frac{1}{8}$ 6 $\frac{2}{3} \div \frac{1}{4}$ $2\frac{2}{3}$

10. $4\frac{1}{5} \div \frac{3}{5}$ 7 $3\frac{1}{8} \div \frac{5}{6}$ $3\frac{3}{4}$ $\frac{5}{16} \div \frac{5}{6}$ $\frac{3}{8}$ $\frac{1}{2} \div \frac{5}{6}$ $\frac{3}{5}$ $\frac{5}{8} \div \frac{1}{4}$ $2\frac{1}{2}$

11. $2\frac{1}{2} \div \frac{3}{4}$ $3\frac{1}{3}$ $8\frac{3}{4} \div \frac{7}{8}$ 10 $\frac{3}{16} \div \frac{3}{4}$ $\frac{1}{4}$ $\frac{1}{3} \div \frac{2}{5}$ $\frac{5}{6}$ $\frac{7}{8} \div \frac{1}{6}$ $5\frac{1}{4}$

12. Divide each one by $\frac{3}{4}$: $\frac{3}{8}$ $\frac{1}{2}$ $\frac{5}{6}$ $1\frac{1}{9}$ $1\frac{7}{8}$ $2\frac{1}{2}$ $8\frac{1}{4}$ 11 $\frac{11}{12}$ $1\frac{2}{9}$

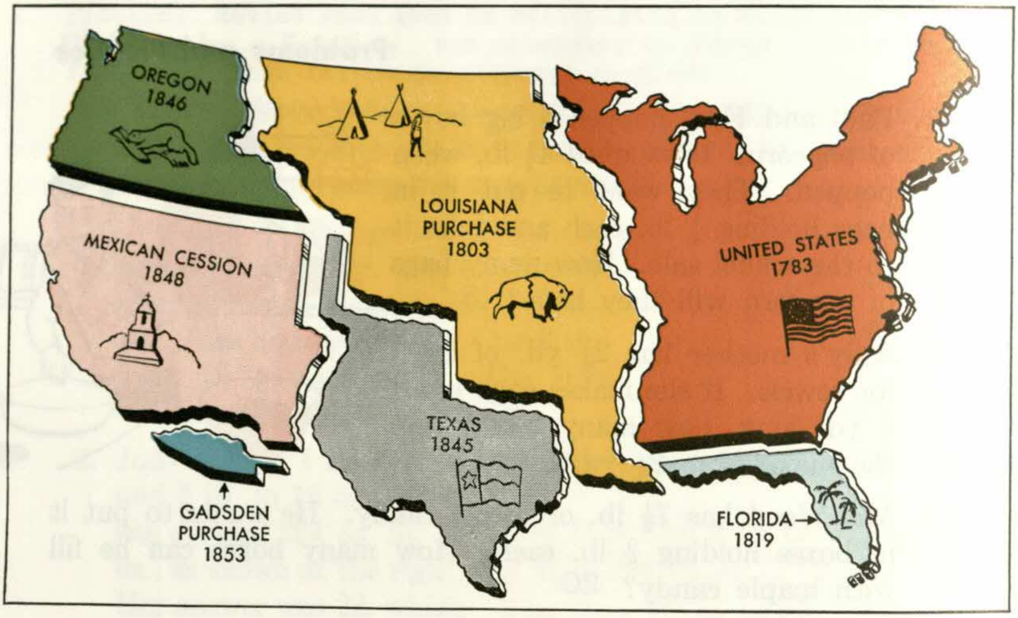
13. Divide each one by $\frac{5}{6}$: $\frac{1}{4}$ $\frac{3}{10}$ $\frac{5}{8}$ $\frac{3}{4}$ $3\frac{1}{2}$ $4\frac{1}{5}$ $3\frac{1}{8}$ $3\frac{3}{4}$ $5\frac{1}{3}$ $6\frac{2}{5}$

14. Divide each one by $\frac{3}{10}$: $\frac{1}{2}$ $1\frac{2}{3}$ $\frac{3}{5}$ 2 $3\frac{3}{8}$ $11\frac{1}{4}$ $2\frac{2}{5}$ 8 $3\frac{3}{4}$ $12\frac{1}{2}$

More Practice. See ㉝ on page 320.

Have volunteers explain ex. 1–3 at board. If there seems to be no difficulty, have pupils complete ex. 4–14 independently. Observe pupils as they work to see that all have good understanding and mastery of skill. Reteach if needed.

Present problems dealing with United States history.



The Growth of Our Country to 1853

1. In 1783 the United States had an area of 888,811 sq. mi. Our country at that time was made up of 13 states. They stretched from Canada to southern Georgia and from the Atlantic Ocean to the Mississippi River.

2. The United States in 1803 bought from France a vast region west of the Mississippi River. This was called the Louisiana Purchase and it added 827,192 sq. mi. of new land to our country. What was the area of the United States after the Louisiana Purchase? See ex. 1.
1,716,003 sq. mi.

3. During the 50 years following the Louisiana Purchase these new regions were added to our country:

1819	East and West Florida	72,003 sq. mi.
1845	Texas	390,144 sq. mi.
1846	Oregon Country	285,580 sq. mi.
1848	Mexican Cession	529,017 sq. mi.
1853	Gadsden Purchase	29,640 sq. mi.

What was the continental area of the United States after these additions? See ex. 2. Since these regions were added,
3,022,387 sq.mi.

Do problems orally with class and encourage pupils to make comparisons concerning costs of regions and sizes of them.

Alaska and Hawaii have also been added to the United States, making its area even larger. *

4. The Louisiana Purchase was the largest single addition to the United States. For about $15,000,000, not including interest, we bought 827,192 sq. mi. of land, which almost doubled the area of our country as it was in 1783. Would it be correct to say that the Louisiana Purchase cost us about $18 per square mile? $14.889456; yes, About how much did it cost per acre? $.03
640 acres = 1 sq. mi. See G-71 for further discussion of cost of Louisiana purchase.

5. The Louisiana Purchase cost us $15,000,000, the Floridas cost $5,000,000; the Mexican Cession cost $18,000,000 plus a later payment of $10,000,000 to Texas; and the Gadsden Purchase cost $10,000,000. There was no payment in money for Texas or Oregon. What was the total cost to us of the addition of all the regions just mentioned? $58,000,000

*Have pupils investigate areas of Alaska and Hawaii and then compute area of United States, including these.

Dividing Fractions by Whole Numbers

1. Problem Martha had a chocolate bar weighing $\frac{1}{2}$ lb. She divided it into 4 equal pieces. What part of a pound was each piece? $\frac{1}{8}$

Explanation When you divide any number by 4, you take $\frac{1}{4}$ of the number. So $\frac{1}{2} \div 4$ is the same as $\frac{1}{4}$ of $\frac{1}{2}$. You see that $\frac{1}{2} \div 4 = \frac{1}{4} \times \frac{1}{2}$, or $\frac{1}{8}$. Each piece of chocolate was $\frac{1}{8}$ lb.

You can do the example $\frac{1}{2} \div 4$ by inverting the divisor and multiplying, as shown at the right. You get the answer $\frac{1}{8}$, as before. You see that the rule for inverting the divisor can also be used when the divisor is a whole number.

$$\frac{1}{2} \div 4 = \frac{1}{2} \div \frac{4}{1} = \frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$$

2. Problem Mrs. Case bought 3 chickens that weighed $8\frac{1}{4}$ lb. in all. What was the average weight per chicken? $2\frac{3}{4}$ lb.

Explanation You must divide $8\frac{1}{4}$ by 3. First Stress. → change $8\frac{1}{4}$ to $\frac{33}{4}$ and → write 3 as $\frac{3}{1}$. Then invert the divisor and multiply. The average weight of the chickens was $2\frac{3}{4}$ lb.

$$8\frac{1}{4} \div 3 = \frac{33}{4} \div \frac{3}{1} = \frac{\overset{11}{\cancel{33}}}{4} \times \frac{1}{\underset{1}{\cancel{3}}} = \frac{11}{4} = 2\frac{3}{4}$$

Emphasize.

To divide a fraction or a mixed number by a whole number, invert the divisor and multiply.

Remind pupils that whole number must be written as fraction.

Divide. Check by going over the work:

3. $\frac{3}{4} \div 6$ $\frac{1}{8}$ $\quad$ $\frac{1}{8} \div 2$ $\frac{1}{16}$ $\quad$ $1\frac{7}{8} \div 3$ $\frac{5}{8}$ $\quad$ $3\frac{3}{4} \div 5$ $\frac{3}{4}$ $\quad$ $2\frac{2}{3} \div 16$ $\frac{1}{6}$

4. $\frac{2}{3} \div 4$ $\frac{1}{6}$ $\quad$ $\frac{3}{5} \div 6$ $\frac{1}{10}$ $\quad$ $2\frac{1}{2} \div 5$ $\frac{1}{2}$ $\quad$ $2\frac{5}{8} \div 7$ $\frac{3}{8}$ $\quad$ $3\frac{3}{4} \div 10$ $\frac{3}{8}$

5. $\frac{3}{8} \div 9$ $\frac{1}{24}$ $\quad$ $\frac{4}{5} \div 8$ $\frac{1}{10}$ $\quad$ $1\frac{4}{5} \div 3$ $\frac{3}{5}$ $\quad$ $4\frac{1}{6} \div 5$ $\frac{5}{6}$ $\quad$ $5\frac{1}{4} \div 12$ $\frac{7}{16}$

More Practice. See ㉞ on page 320. Use to reinforce understanding.

Discuss ex. 1-2 carefully with pupils. Have pupils use fractional cutouts to find answers to some simple examples ($\frac{1}{2} \div 2$, $\frac{2}{3} \div 2$, $\frac{3}{4} \div 3$) to lead them to see that dividing by whole numbers is same as multiplying by inverted form of whole number.

Review work in division of fractions.

Problems and Practice

1. The ferry at Sandy Point runs from 10 A.M. until 5:30 P.M. It takes $\frac{3}{4}$ hr. for the ferry to load and make a trip across the river and back. How many round trips does the ferry make a day? 10

2. On the 5 school days last week, Danny practiced on his horn $3\frac{3}{4}$ hr. What was the average time he practiced a day? $\frac{3}{4}$ hr.

3. Ann divided $\frac{1}{4}$ lb. of butter into 8 pieces. What part of a pound was each piece? $\frac{1}{32}$

4. Nancy made 4 lb. of candy to sell. She put it in bags with $\frac{1}{2}$ lb. of candy in each bag. How many bags did she have? 8

5. Miss Clark gives music lessons. Each lesson is $\frac{1}{2}$ hr. long. How many lessons can she give in $2\frac{1}{2}$ hr.? 5

Have pupils check answers by seeing if they are sensible, using estimation and place value.

Divide. Check by going over the work:

6. $\frac{2}{3} \div 8$ $\frac{1}{12}$ $3 \div \frac{2}{3}$ $4\frac{1}{2}$ $\frac{9}{16} \div \frac{3}{8}$ $1\frac{1}{2}$ $\frac{9}{10} \div 12$ $\frac{3}{40}$ $1\frac{4}{5} \div 3$ $\frac{3}{5}$

7. $3 \div \frac{1}{2}$ 6 $6 \div \frac{1}{4}$ 24 $1\frac{7}{8} \div 5$ $\frac{3}{8}$ $1\frac{3}{5} \div 16$ $\frac{1}{10}$ $6\frac{1}{4} \div \frac{5}{6}$ $7\frac{1}{2}$

8. $\frac{1}{4} \div \frac{1}{8}$ 2 $\frac{7}{8} \div \frac{3}{4}$ $1\frac{1}{6}$ $10 \div \frac{2}{3}$ 15 $8\frac{1}{6} \div 14$ $\frac{7}{12}$ $\frac{9}{16} \div \frac{5}{8}$ $\frac{9}{10}$

9. $\frac{7}{8} \div \frac{1}{4}$ $3\frac{1}{2}$ $2 \div \frac{5}{8}$ $3\frac{1}{5}$ $2\frac{1}{2} \div \frac{5}{8}$ 4 $\frac{5}{12} \div \frac{1}{10}$ $4\frac{1}{6}$ $6\frac{2}{3} \div 4$ $1\frac{2}{3}$

10. $6 \div \frac{3}{4}$ 8 $\frac{1}{2} \div \frac{3}{4}$ $\frac{2}{3}$ $15 \div \frac{3}{8}$ 40 $18 \div \frac{9}{10}$ 20 $5\frac{2}{5} \div 9$ $\frac{3}{5}$

11. $8 \div \frac{2}{5}$ 20 $\frac{1}{3} \div \frac{5}{6}$ $\frac{2}{5}$ $1\frac{4}{5} \div 9$ $\frac{1}{5}$ $5\frac{3}{5} \div \frac{7}{10}$ 8 $7\frac{1}{2} \div \frac{5}{6}$ 9

12. $5 \div \frac{1}{2}$ 10 $\frac{3}{4} \div \frac{1}{3}$ $2\frac{1}{4}$ $2\frac{1}{2} \div \frac{2}{5}$ $6\frac{1}{4}$ $2\frac{2}{3} \div 16$ $\frac{1}{6}$ $15 \div \frac{3}{4}$ 20

13. $\frac{1}{4} \div \frac{1}{6}$ $1\frac{1}{2}$ $\frac{5}{8} \div \frac{1}{4}$ $2\frac{1}{2}$ $5\frac{1}{4} \div 3$ $1\frac{3}{4}$ $1\frac{3}{4} \div \frac{7}{12}$ 3 $2\frac{2}{5} \div 6$ $\frac{2}{5}$

14. $\frac{2}{3} \div \frac{5}{6}$ $\frac{4}{5}$ $\frac{2}{3} \div 4$ $\frac{1}{6}$ $6\frac{1}{2} \div \frac{2}{3}$ $9\frac{3}{4}$ $4\frac{3}{8} \div \frac{5}{12}$ $10\frac{1}{2}$ $\frac{7}{12} \div \frac{1}{2}$ $1\frac{1}{6}$

More Practice. See ㉟ on page 321. Use for reteaching as needed.

Ex. 1–5 may be done as class activity to check understandings and clear up any difficulties. Then have pupils complete ex. 6–14 independently. Note if errors are caused by mixed numbers, inverting wrong fraction, whole-number divisors, and so on.

Dividing by a Mixed Number

1. Problem The tennis court at Chapman Park can be used from 9 A.M. to 6 P.M. on week days. Groups sign up to use the court for $1\frac{1}{2}$ hr. each. How many groups can use the court each day? 6

Explanation The court can be used 9 hr. each day. So you need to divide 9 by $1\frac{1}{2}$. Write 9 as $\frac{9}{1}$ and $1\frac{1}{2}$ as $\frac{3}{2}$. Then invert the divisor and multiply, which gives 6. So 6 groups can use the tennis court each day.

$$9 \div 1\frac{1}{2} = \frac{9}{1} \div \frac{3}{2} = \frac{\overset{3}{\cancel{9}}}{1} \times \frac{2}{\underset{1}{\cancel{3}}} = 6$$

2. Fred says he can do ex. 1 another way. He changes both 9 hr. and $1\frac{1}{2}$ hr. to minutes so that he will have whole numbers to work with. Then he divides. How many minutes are 9 hr.? 540 $1\frac{1}{2}$ hr.? 90 Do the work Fred's way. Do you get the same answer as in ex. 1? 6 groups, yes

3. Mrs. Page paid \$1.00 for $2\frac{1}{2}$ doz. plants for her garden. What was the cost of the plants per dozen? \$.40

▶ Write \$1.00 as $\frac{\$1.00}{1}$ and $2\frac{1}{2}$ as $\frac{5}{2}$; invert $\frac{5}{2}$ and multiply.

Emphasize.

To divide by a mixed number, change the mixed number to an improper fraction; then invert the divisor and multiply.

Do ex. 4–5 as class activity. Remind pupils to cancel where possible.

Divide. Check your work by going over it:

4. $8 \div 4\frac{4}{5}$ $1\frac{2}{3}$ $12\frac{1}{2} \div 3\frac{3}{4}$ $3\frac{1}{3}$ $10 \div 1\frac{1}{4}$ 8 $\$2.50 \div 6\frac{1}{4}$ $\$.40$

5. $\frac{3}{4} \div 1\frac{1}{8}$ $\frac{2}{3}$ $10\frac{1}{2} \div 2\frac{1}{3}$ $4\frac{1}{2}$ $18 \div 2\frac{1}{4}$ 8 $\$1.25 \div 8\frac{1}{3}$ $\$.15$

6. $\frac{4}{5} \div 3\frac{1}{5}$ $\frac{1}{4}$ $11\frac{1}{4} \div 3\frac{1}{8}$ $3\frac{3}{5}$ $3\frac{1}{2} \div 8\frac{3}{4}$ $\frac{2}{5}$ $\$3.00 \div 7\frac{1}{2}$ $\$.40$

7. $7 \div 1\frac{1}{6}$ 6 $11\frac{2}{3} \div 1\frac{1}{6}$ 10 $1\frac{7}{8} \div 1\frac{1}{4}$ $1\frac{1}{2}$ $\$1.50 \div 3\frac{3}{4}$ $\$.40$

More Practice. See ㊱ on page 321.

This work should not present difficulty if pupils are reminded that mixed number must be changed to improper fraction before it can be used as divisor. Also, stress fact that whole numbers must be written as fractions.

Provide further practice in division by mixed number.

At Camp

1. Mr. Chase drove Jim and Bob to camp in $3\frac{1}{2}$ hr. The distance was 133 mi. Find the average speed of the car in miles per hour. 38

2. At camp Jim walked 14 mi. one day. It took him 3 hr. 20 min. all together. What was his average rate of walking in miles per hour? $4\frac{1}{5}$
   ▶ First change 3 hr. 20 min. to $3\frac{1}{3}$ hr.

3. Bob says he can walk an average of $3\frac{1}{2}$ mi. per hour. How many hours will he take to walk $8\frac{3}{4}$ mi.? $2\frac{1}{2}$ 14 mi.? 4

4. The boys took 1 hr. 40 min. to climb to the top of Eagle Mountain. The distance was only $2\frac{1}{2}$ mi. but the path was steep. What was their average rate in miles per hour? $1\frac{1}{2}$

Divide. Check your work by going over it:

5. $4 \div 1\frac{1}{5}$ $3\frac{1}{3}$ $\frac{11}{12} \div 8\frac{1}{4}$ $\frac{1}{9}$ $8\frac{1}{4} \div 5\frac{1}{2}$ $1\frac{1}{2}$ $6 \div 1\frac{1}{2}$ 4

6. $\frac{7}{8} \div 4\frac{2}{3}$ $\frac{3}{16}$ $\frac{15}{16} \div 3\frac{1}{8}$ $\frac{3}{10}$ $3\frac{1}{3} \div 4\frac{1}{6}$ $\frac{4}{5}$ $4 \div 6\frac{2}{3}$ $\frac{3}{5}$

7. $6 \div 1\frac{1}{3}$ $4\frac{1}{2}$ $\frac{7}{10} \div 4\frac{1}{5}$ $\frac{1}{6}$ $45 \div 1\frac{7}{8}$ 24 $9 \div 2\frac{1}{4}$ 4

8. $\frac{3}{4} \div 2\frac{2}{3}$ $\frac{9}{32}$ $24 \div 5\frac{1}{3}$ $4\frac{1}{2}$ $8\frac{3}{4} \div 4\frac{2}{3}$ $1\frac{7}{8}$ $\frac{7}{8} \div 1\frac{1}{2}$ $\frac{7}{12}$

9. $9 \div 1\frac{1}{2}$ 6 $\frac{7}{16} \div 5\frac{1}{4}$ $\frac{1}{12}$ $5\frac{3}{5} \div 4\frac{1}{5}$ $1\frac{1}{3}$ $\frac{4}{5} \div 3\frac{1}{5}$ $\frac{1}{4}$

More Practice. See ㊲ on page 321. Use for reteaching.

Ex. 1–4 may be done by volunteers at blackboard. Have them explain each step in their work. If there are no questions, assign ex. 5–9. Note any difficulties and plan for reteaching, using materials, diagrams, and so on.

Review of Decimals

1. Write these fractions as decimals:

$\frac{4}{10}$ .4 $\frac{2}{100}$ .02 $\frac{19}{100}$ .19 $\frac{513}{1000}$ .513 $\frac{87}{100}$ .87 $\frac{37}{1000}$ .037 $\frac{3}{1000}$ .003

2. Write these decimals as fractions:

.04 $\frac{1}{25}$ .3 $\frac{3}{10}$ .008 $\frac{1}{125}$ .465 $\frac{93}{200}$ .029 $\frac{29}{1000}$ .14 $\frac{7}{50}$ .6 $\frac{3}{5}$

Copy in columns, add, and check: Emphasize that only numbers in like places can be added.

3. 6.583 + 7.821 + 5.333 + 7.875 + 3.645 + 8.125 39.382

4. 4.25 + 1.42 + .56 + 8.73 + 2.66 + 5.85 + 6.75 30.22

5. .14 + .59 + .38 + .19 + .86 + .53 + .75 + .47 3.91

6. 3.4 + 8.5 + 2.4 + 9.0 + 1.5 + 7.1 + 6.6 + 8.8 47.3

7. 1.25 + 6.5 + 8.375 + 1.875 + 4.75 + 3.5 + 6.125 32.375

Copy in columns, subtract, and check:

8. 9.8 − 4.2 5.6   4.5 − .375 4.125   8 − 4.8 3.2   3 − 1.52 1.48

9. 4.7 − 1.9 2.8   3.6 − 1.25 2.35   7 − 3.5 3.5   5 − 4.75 .25

10. Is the approximate answer to 8 × 1.02 about 8 or about 80? 8 Is the approximate answer to .9 × 8.9 about 8 or 80? 8 Is the approximate answer to 1.7 × 10.05 about 17 or 170? 17

Have pupils check some problems using common fractions.

Multiply. Check your work by going over it:

11.	23 .05 1.15	2.5 .7 1.75	3.46 .4 1.384	700 4.2 2940.0	.007 8 .056	248 .011 2.728
12.	63 .18 11.34	6.7 .37 2.479	.006 16 .096	582 .09 52.38	11.4 .04 .456	46.7 5.2 242.84
13.	.43 6 2.58	.08 2.4 .192	5.36 1.2 6.432	250 4.1 1025.0	1.75 .7 1.225	.007 14 .098
14.	.09 11 .99	8.2 3.1 25.42	11.6 .07 .812	538 .001 .538	13.9 2.5 34.75	1.02 3.3 3.366

Check papers carefully and note kinds of errors. Help pupils determine causes of mistakes. Then assign remedial work as needed. Let others work on magic squares (using decimals).

Present another set of improvement tests in subtraction of whole numbers.

Improving by Practice

Subtraction Test 3a.

Time: 4 min.

1.	67148 25025 42,123	29784 16995 12,789	25394 16875 8519	14570 13868 702	
2.	62700 28469 34,231	12547 10868 1679	70034 56229 13,805	80000 40259 39,741	
3.	85136 53854 31,282	33959 17066 16,893	60122 46354 13,768	46665 36894 9771	⑫

Subtraction Test 3b.

Time: 4 min.

4.	67495 42382 25,113	51826 48879 2947	39150 26783 12,367	90000 34291 55,709	
5.	42165 28331 13,834	85000 49999 35,001	40748 36368 4380	57573 19697 37,876	
6.	91616 43661 47,955	97165 25759 71,406	40025 38517 1508	26524 19891 6633	⑫

Subtraction Test 3c.

Time: 4 min.

7.	48665 34313 14,352	24500 21375 3125	88205 56331 31,874	20000 19362 638	
8.	55555 38294 17,261	60053 36746 23,307	71588 58549 13,039	16660 14867 1793	
9.	73285 23324 49,961	13570 12759 811	42953 26457 16,496	40000 18499 21,501	⑫

Check papers and, through individual conferences, determine causes of errors. Have pupils record scores and compare them with previous ones (pages 67, 127). Plan remedial work.

Show how to compare larger number with smaller one and apply this work to problem solving (pages 184–185).

Comparing Numbers

1. Bob is 12 yr. old. His brother is 4 yr. old. Bob is how many times as old as his brother? 3

2. When Bob was born he weighed 7 lb. Today he weighs 84 lb. Bob's present weight is how many times as great as his weight when he was born? 12

3. Frank saved $60 last year and Paul saved $30. Frank saved how many times as much money as Paul? 2

4. The elephant in the zoo weighs 8241 lb. Joe weighs 67 lb. The elephant is how many times as heavy as Joe? 123

5. Mary Ann's home is only 37 mi. from New York but it is 962 mi. from St. Louis. St. Louis is how many times as far away from Mary Ann's home as New York? 26

6. Jerry has just started a stamp collection. He has 72 stamps in it. Mr. Wood has 1314 stamps in his collection. Mr. Wood has how many times as many stamps as Jerry? $18\frac{1}{4}$

Emphasize after demonstration.

To find how many times as large one number is as another, divide the larger number by the smaller.

Find the number to put in each space:

7. 2000 lb. is $\overset{25}{\ldots}$ times as heavy as 80 lb.

8. 1500 mi. is $\overset{6}{\ldots}$ times as far as 250 mi.

9. $22,400 is $\overset{640}{\ldots}$ times as large as $35.

10. 5280 ft. is $\overset{8}{\ldots}$ times as long as 660 ft.

11. 144 doz. is $\overset{6}{\ldots}$ times as many as 24 doz.

12. $75,000 is $\overset{600}{\ldots}$ times as large as $125.

More Practice. See ㊳ on page 322.

First have pupils use materials and drawings to compare two groups (4 and 2, 6 and 3). Let them state generalization in own words. Have them make up simple problems comparing objects in class. Urge use of phrases, "how many times as great or as large."

Do problems with pupils, letting volunteers explain solutions to ex. 2–5. If pupils show lack of understanding, review (using materials) work on page 184. Then have pupils solve some simple problems.

Making Cupcakes

1. **Problem** The girls in the cooking class learned to make cupcakes yesterday. They found that they could make 12 cupcakes from one recipe at a total cost of \$.21. Tomorrow they plan to make 84 cupcakes to serve in the school lunchroom. What will be the cost of these cupcakes? \$1.47

   Explanation You know that 84 cupcakes are 7 times as many as 12 cupcakes. The girls must make 7 times as many cupcakes to have 84 in all. If it cost \$.21 to make 12 cupcakes, it will cost 7 × \$.21 to make 84 cupcakes. How much is 7 × \$.21? \$1.47

2. In the lunchroom the girls sell 2 cupcakes for 7¢. For how much will they sell 84 cupcakes? 84 is how many times as large as 2? 42 \$2.94

3. If the girls put chocolate frosting on the cupcakes it will cost \$.29 to make 12 cupcakes. How much will it cost to make 30 cupcakes with chocolate frosting? \$.73

4. Last week the girls in the cooking class made 180 oatmeal cookies. The recipe the girls used calls for 2 eggs to make 36 cookies. How many eggs did they use for 180 cookies? 10

5. The recipe also calls for 2 oz. of butter for 36 cookies. How many ounces of butter did they use for 180 cookies? 10

Urge better students to make up original problems while you give more help to those having difficulty.

Show how to compare smaller number with larger one and apply this work to problem solving (pages 186–187). As on page 184, have pupils use objects and make drawings to show comparisons of two groups (2 and 4, 6 and 10, and so on).

The Garden Center

1. Problem Mr. Ward has a store where he sells flowers, plants, and garden supplies. At Easter he had 96 pots of Easter lilies to sell. He sold 16 of these to the Glee Club to decorate the hall for an Easter program. What part of the 96 pots did he sell to the Glee Club? $\frac{1}{6}$

Explanation 16 is $\frac{16}{96}$ of 96. Changing $\frac{16}{96}$ to lowest terms, you get $\frac{1}{6}$. So $\frac{1}{6}$ of the 96 pots of Easter lilies were sold to the Glee Club.

Emphasize after demonstration.

To find what part one number is of a larger number, write the smaller number over the larger one to make a fraction. Change the fraction to lowest terms.

2. Mr. Ward sold 24 pots of Easter lilies to a church. What part of the 96 pots of lilies did he sell to the church? $\frac{1}{4}$

3. Mr. Ward sold the rest of the Easter lilies to people who came to his store. What part of the 96 pots of lilies did he sell in the store? $\frac{7}{12}$

4. Mr. Ward sells one kind of roses for \$4.00 a dozen. How much would he charge for 6 roses? \$2.00 for 9 roses? \$3.00 for 8 roses? \$2.67

Have pupils make up problems comparing two like quantities, for class to solve.

5. Mr. Ward sells 25 potted strawberry plants for $4.50. How much would he charge for 10 plants? $1.80 for 50 plants? $9.00

6. Last August Mr. Ward had 600 pots of strawberry plants to sell. Of this number only 25 plants were not sold. How many plants were sold? 575 What part of the plants were sold? $\frac{23}{24}$ What part were not sold? $\frac{1}{24}$

7. Mr. Ward had 12 doz. snapdragons to sell. How many snapdragons in all did he have? 144

8. He sold the snapdragons at 6 for 76¢. How much did he get for 12 doz. snapdragons? $18.24

9. Mr. Ward sells potted African violets at 2 for 95¢. What would he charge for 4 African violets? $1.90 for 6 African violets? $2.85

10. Mr. Ward sells 10 lb. of grass seed for $11.50. What would he charge for 2 lb. of seed? $2.30 for 5 lb.? $5.75 for 25 lb.? $28.75

11. Bob delivers flowers for Mr. Ward. Yesterday morning he delivered some flowers at Mrs. Smith's house. It took him 15 min. in all. What part of an hour is 15 min.? $\frac{1}{4}$ In the afternoon Bob delivered a plant at Mrs. White's house. The trip took 45 min. What part of an hour is that? $\frac{3}{4}$

12. There are 20 blocks to the mile in the city where Bob lives. Today he walked 10 blocks to deliver a plant. What part of a mile did he walk? $\frac{1}{2}$

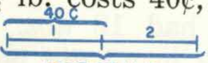
Note that work on page 185 is also reviewed in ex. 5-12.

Show how to find the whole when a part of it is given.

Finding the Whole Amount

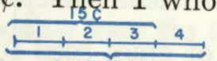
1. Problem Bob paid 40¢ for $\frac{1}{2}$ lb. of candy. If he had bought 1 lb. of candy, what would it have cost? 80¢

Explanation In this problem you know the cost of $\frac{1}{2}$ lb. of candy, and want to find the cost of 1 **whole** pound. There are 2 **halves** in 1 whole. If $\frac{1}{2}$ lb. costs 40¢, 1 whole pound will cost 2 × 40¢, or 80¢.



2. Problem Patty bought $\frac{3}{4}$ yd. of ribbon for 15¢. How much will 1 yd. of ribbon cost? 20¢

Explanation First find the cost of $\frac{1}{4}$ yd. of ribbon. $\frac{1}{4}$ yd. of ribbon costs $\frac{1}{3}$ as much as $\frac{3}{4}$ yd. $\frac{3}{4}$ yd. costs 15¢, so $\frac{1}{4}$ yd. costs $\frac{1}{3}$ of 15¢, or 5¢. Then 1 whole yard, or $\frac{4}{4}$ yd., will cost 4 × 5¢, or 20¢.



3. Ann put $2.75 in the bank. This was $\frac{1}{3}$ of the money she earned last month. How much did Ann earn last month? $8.25

4. Paul has saved $12.50 for camp next summer. This amount is only $\frac{1}{4}$ of the money he needs to go to camp. How much money does Paul need for camp? $50.00

5. Mary paid 45¢ for a ticket to the musical program. She got it for $\frac{3}{4}$ of the regular price because she is a school pupil. What was the regular price of a ticket? 60¢

6. Joseph bought a bicycle for $28.40 because it was an old model. This was $\frac{2}{3}$ of the regular price of the bicycle. What was the regular price? $42.60

Have pupils use diagrams in ex. 7-11 if necessary.

Tell what number should be put in each space:

7. 5 is $\frac{1}{5}$ of ... 25 20 is $\frac{1}{8}$ of ... 160 12 is $\frac{1}{6}$ of ... 72

8. 9 is $\frac{1}{3}$ of ... 27 15 is $\frac{1}{2}$ of ... 30 60 is $\frac{1}{4}$ of ... 240

9. 6 is $\frac{2}{3}$ of ... 9 18 is $\frac{3}{8}$ of ... 48 55 is $\frac{5}{6}$ of ... 66

10. 9 is $\frac{3}{4}$ of ... 12 49 is $\frac{7}{8}$ of ... 56 72 is $\frac{3}{5}$ of ... 120

11. 4 is $\frac{1}{6}$ of ... 24 75 is $\frac{5}{6}$ of ... 90 48 is $\frac{2}{3}$ of ... 72

More Practice. See ㊴ on page 322.

Use diagrams, as shown above, in discussing solutions to ex. 1-2. Have pupils make similar diagrams for ex. 3-6. Let volunteers explain their solutions, with aid of diagrams. Have pupils complete ex. 7-11 independently.

Present review of previous work involving whole numbers, decimal and common fractions.

Mixed Practice

Add these numbers:

1. $6\frac{5}{12} + 3\frac{11}{12}$ = $10\frac{1}{3}$ $4\frac{3}{4} + 7\frac{1}{2}$ = $12\frac{1}{4}$

Subtract these numbers:

2. $\$62.80 - 53.79$ = $\$9.01$ $8\frac{1}{2} - 4\frac{2}{3}$ = $3\frac{5}{6}$

Multiply these numbers:

3. $7\frac{1}{2} \times 2\frac{2}{3}$ 20 43.09×9.5 = 409.355

Divide these numbers:

4. $33\overline{)528}$ 16 $217\overline{)9379}$ 43R48

Study each exercise carefully. Then work it:

5. Find the difference between 8423 and 1695. 6728

6. Find the average of 48, 81, 35, 69, 56, 17. 51

7. Divide 2355 by 8; use the remainder to give a fraction in the quotient. $294\frac{3}{8}$

8. 285 is how many times as large as 15? 19 18 is how many times as large as $\frac{1}{2}$? 36 $10\frac{1}{2}$ is how many times as large as $1\frac{1}{2}$? 7

9. What part of 12 is 9? $\frac{3}{4}$ What part of 56 is 28? $\frac{1}{2}$

10. 72 is $\frac{1}{2}$ of what number? 144 24 is $\frac{2}{3}$ of what number? 36 100 is $\frac{5}{8}$ of what number? 160

11. Multiply $\frac{3}{4}$ by $2\frac{2}{3}$. 2 Multiply $1\frac{7}{8}$ by $\frac{4}{5}$. $1\frac{1}{2}$

12. Add $3\frac{1}{10}$, $2\frac{1}{2}$, and $4\frac{1}{5}$. Then subtract the sum from 15. $5\frac{1}{5}$

13. Round off each number to the nearest thousand: 1973, 3104, 5827, 8427, 7781. 2000 3000 6000 8000 8000

14. Round off each number to the nearest hundred: 179, 428, 889, 937, 1471, 4704, 6983. 200, 400, 900, 900, 1500, 4700, 7000

15. Multiply 125 by .002; .250 by .02; 2.50 by .2. 25.0

16. Which of these numbers is the most reasonable answer for $.9 \times .16$? 144, 14.4, 1.44, .144. .144

17. Find the difference between \$15 and \$4.29. \$10.71

18. Find the sum of these decimals: 2.47, 17.73, 4.69. 24.89

Urge pupils who seem to have difficulty to do computations aloud to check their understanding. If most of class seem weak in particular area, reteach using developmental material in text. Plan remedial activities as needed.

Present problems containing extra facts. Let pupils do these independently. Then have them discuss how they selected necessary facts, and explain why other facts are unnecessary.

Which Numbers Are Not Needed?

In the problems on this page some numbers are given that are not needed in finding the answer. Tell which numbers are not needed and then work the problem:

1. It is 75 mi. to Westfield by the new road. The old road is 16 mi. longer. At an average speed of 30 mi. an hour, how many hours will it take to drive to Westfield by the new road? "16 mi." not needed; $2\frac{1}{2}$ hr.

2. Susan's mother will be 34 yr. old on June 1. Susan wants to buy her 6 handkerchiefs for a present. She saw some handkerchiefs at 2 for $.75. How much must Susan pay for 6 handkerchiefs of this kind? "34 yr." not needed; $2.25

3. Dan, Bob, and Dick went fishing. They rented a boat for 3 hr. at 45¢ an hour. The boys caught 10 fish in all. If they shared the cost of the boat, how much did each boy pay? "10 fish" not needed; 45¢

4. Mrs. Cook bought 3 spools of white thread at 5¢ each and 2 spools of black thread at 9¢ each. There were 50 yd. of thread on each spool of white thread and 100 yd. of thread on each spool of black thread. How much did Mrs. Cook pay for the thread? "50 yd." and "100 yd." not needed; 33¢

5. Last winter eggs sometimes cost 75¢ a dozen. Now there are more eggs and the price is 52¢ a dozen. How much must Mrs. Fox pay for $1\frac{1}{2}$ doz. eggs now? (1) How much must she pay for $2\frac{1}{2}$ doz. eggs now? (2) "75¢" not needed; (1) 78¢; (2) $1.30

6. Fred's rate of walking is usually 3 mi. per hour. One day he walked $6\frac{1}{2}$ mi. in 2 hr. Find his rate that day. "3 mi." not needed; $3\frac{1}{4}$ mi.

7. Mary earned 25¢ and her father gave her 35¢. She wants to buy 6 pencils that sell at 3 pencils for 10¢. How much will 6 pencils cost? "25¢" and "35¢" not needed; 20¢

8. Bill bought a pad of 50 sheets of typewriter paper for 29¢. He also bought 6 pencils for 20¢. How much change did Bill get from $1.00? "50 sheets" not needed; $.51

Present review of some common measures.

Problems on Measures

1. How many yards of ribbon does Mrs. Bridge need to bind a baby blanket 30 in. wide and 40 in. long? She allows 1 in. extra to turn each corner. 4 yd.

2. Miss Bell charges \$2.25 for a music lesson 45 min. long. At this rate what would she charge per hour? \$ 3.00

3. Fred picked 2 bushels of peaches. He put the peaches in baskets each holding 2 quarts and sold them for 35¢ a basket. How much did he get for the peaches? \$11.20

4. What part of a pound is 8 oz.? $\frac{1}{2}$ 14 oz.? $\frac{7}{8}$ 12 oz.? $\frac{3}{4}$

5. At \$.56 a pound, find the cost of 4 lb. 12 oz. of meat. \$2.66

6. Which has the larger area, a square 12 ft. on a side (144 sq.ft.) or a rectangle 15 ft. long and 9 ft. wide? (135 sq.ft.) The square How much larger is it? 9 sq.ft.

7. How many 8-ounce boxes can be filled with $3\frac{1}{2}$ lb. of candy? 7 Will any candy be left over? No

8. Jim pays 5¢ for a candy bar that weighs $1\frac{3}{4}$ oz. How many of these bars should Jim buy if he wants about 1 lb. of candy? 9 Give your answer to the nearest whole bar. Do these bars together weigh just a pound, or a little more than a pound, or a little less than a pound? A little less What is the cost of these bars? 45¢

What number goes in each space?

9. 1 hr. = 3600 sec. 60 in. = 5 ft. $2\frac{1}{4}$ min. = 135 sec.
10. $\frac{1}{2}$ ft. = 6 in. 12 ft. = 4 yd. $3\frac{1}{2}$ gal. = 14 qt.
11. $\frac{3}{8}$ yd. = $13\frac{1}{2}$ in. 10 ft. = $3\frac{1}{3}$ yd. $1\frac{1}{4}$ lb. = 20 oz.
12. $\frac{1}{4}$ hr. = 15 min. $4\frac{1}{4}$ ft. = 51 in. $1\frac{3}{4}$ hr. = 105 min.
13. $\frac{1}{4}$ lb. = 4 oz. 14 oz. = $\frac{7}{8}$ lb. 18 in. = $1\frac{1}{2}$ ft.
14. $\frac{3}{4}$ mi. = 3960 ft. 27 in. = $2\frac{1}{4}$ ft. 32 oz. = 2 lb.
15. $\frac{3}{4}$ yd. = 27 in. $1\frac{1}{4}$ mi. = 6600 ft. 56 oz. = $3\frac{1}{2}$ lb.
16. $\frac{1}{4}$ bu. = 8 qt. $1\frac{1}{2}$ yd. = 54 in. 50 min. = $\frac{5}{6}$ hr.

Have pupils do ex. 1-16. Refer them to measures' tables on page 305 if necessary. Determine if finding fractional part of number, changing to equivalent measure, and so on, cause difficulty.

Present review of addition and subtraction of decimal fractions.

Addition and Subtraction

Add up. Check your work by adding down: Stress.

1.	$245.80	$137.82	$659.86	$350.00
	46.12	92.98	8.84	80.75
	9.00	312.40	245.40	125.58
	87.73	6.37	83.33	8.20
	562.94	105.54	4.25	44.85
	19.95	7.68	286.89	619.13
	$971.54	$662.79	$1288.57	$1228.51
2.	$989.12	$411.30	$125.14	$364.80
	141.72	800.00	6.50	147.38
	18.45	6.54	212.38	5.56
	615.90	25.50	55.70	84.62
	4.09	8.85	3.13	266.81
	7.75	47.89	526.94	16.58
	$1777.03	$1300.08	$929.79	$885.75

Copy in columns, add, and check:

3. 24.7 + 89.2 + 70.1 + 53.2 + 49.6 + 10.5 297.3

4: .297 + .463 + .901 + .670 + .155 + .056 2.542

5. 1.63 + 18.4 + 5.293 + 4.75 + 6.3 + 4.971 41.344

Subtract. Check your work by adding: Stress.

6.	$70.00	$54.96	$600.75	$510.07
	27.09	12.25	200.98	499.89
	$42.91	$42.71	$399.77	$ 10.18
7.	$47.83	$60.77	$973.45	$800.00
	41.96	27.58	405.82	534.16
	$ 5.87	$33.19	$567.63	$265.84
8.	$10.08	$40.00	$100.00	$724.18
	9.82	29.85	99.24	721.99
	$ .26	$10.15	$ .76	$ 2.19
9.	$50.00	$38.85	$900.50	$275.00
	23.81	19.92	886.75	195.19
	$26.19	$18.93	$ 13.75	$79.81

Copy in columns, subtract, and check:

10. 7.2 − 1.8 5.4 42.3 − 14.9 27.4 $5 − $1.46 $3.54 $12 − $3.98 $8.02

11. 8.0 − 4.2 3.8 80.7 − 23.4 57.3 $7 − $2.97 $4.03 $26 − $4.49 $21.51

Remind pupils that only numbers in like places can be added. Group pupils who had mistakes to help them discover causes (carrying, regrouping, ragged decimals, carelessness). Have them do computation orally to check thinking.

Give true-false test reviewing various skills and concepts. Tell pupils that, in scoring, number of incorrect answers will be subtracted from number of correct ones, to discourage guessing.

Yes or No?

Read each statement below. Then tell whether it is right or wrong by saying "Yes" or "No":

1. The number 6246 is divisible by 9. Yes
2. At 4 lemons for 15¢, 12 lemons cost 45¢. Yes
3. The Roman numeral MCMLIX stands for 1954. No; 1959
4. When $\frac{24}{72}$ is changed to lowest terms, it becomes $\frac{1}{4}$. No; $\frac{1}{3}$
5. At 12 handkerchiefs for \$3.00, 4 handkerchiefs cost \$1.00. Yes
6. The least common denominator for $\frac{2}{3}$, $\frac{1}{6}$, and $\frac{1}{4}$ is 24. No; 12
7. $6\frac{2}{3}$ is a mixed decimal. 4.5 is a mixed number. No; reverse is true.
8. The area of a rectangle 6 ft. by $8\frac{1}{2}$ ft. is 51 sq. ft. Yes
9. When .06 is multiplied by 1.2, the product is .072. Yes
10. The perimeter of a square $4\frac{3}{4}$ ft. on a side is 19 ft. Yes
11. When .9 is multiplied by .7, the product is .063. No; .63
12. If $\frac{5}{8}$ lb. of cheese costs 40¢, the cheese costs 62¢ a pound. No; 64¢
13. When 83,459,108 is rounded off to the nearest million, it becomes 83,000,000. Yes
14. When the divisor is 472, you divide by 5 to estimate the quotient figure. Yes
15. To find what part 18¢ is of 72¢, divide 72¢ by 18¢. The answer is 4. No; $18 \div 72 = \frac{18}{72} = \frac{1}{4}$
16. Jim has 220 stamps in his collection. Bob has half as many stamps as Jim. So Bob has 110 stamps. Yes
17. A box that weighs 12 lb. is 6 times as heavy as a box that weighs $2\frac{1}{2}$ lb. No; $4\frac{4}{5}$ times
18. When a 6-inch piece of gummed paper is cut into $\frac{1}{2}$-inch lengths, there are 12 pieces. Yes
19. When the divisor is 629, you divide by 7 to estimate the quotient figure. No; divide by 6

Have pupils prove their answers to discourage guessing and to check understandings. Let volunteers explain answers giving reasons for choice. Spot-check for class or individual weaknesses and plan remedial work.

See G-75 for correlation of examples with aims.

Chapter Review

1. Ann sleeps 9 hr. every night. What part of the whole day of 24 hr. does Ann spend sleeping? $\frac{9}{24} = \frac{3}{8}$

2. Betsy paid 15¢ for $\frac{1}{4}$ yd. of ribbon. How much did the ribbon cost per yard? 60¢

3. At 6 oranges for 25¢, how much will 30 oranges cost? $1.25

4. Mr. Hill charges $4.50 for 12 roses. At that price, how much does he charge for 4 roses? $1.50 for 6 roses? $2.25

5. The baby elephant at the zoo weighs 250 lb. and its mother weighs 8000 lb. The mother elephant is how many times as heavy as the baby elephant? 32

6. Frank says that the suit he bought for $27.30 cost him only $\frac{3}{4}$ of the regular price. What was the regular price of the suit Frank bought? $36.40

Divide. Check by going over the work:

7. $8 \div \frac{2}{3}$ 12 — $2\frac{1}{3} \div \frac{1}{3}$ 7 — $28 \div 4\frac{1}{5}$ $6\frac{2}{3}$ — $\frac{1}{3} \div 2\frac{2}{3}$ $\frac{1}{8}$

8. $\frac{4}{5} \div 2$ $\frac{2}{5}$ — $1\frac{2}{3} \div 4$ $\frac{5}{12}$ — $6\frac{2}{3} \div 1\frac{2}{3}$ 4 — $\frac{1}{2} \div 2\frac{1}{2}$ $\frac{1}{5}$

9. $\frac{3}{4} \div \frac{2}{5}$ $1\frac{7}{8}$ — $27 \div \frac{3}{4}$ 36 — $5\frac{2}{5} \div 2\frac{1}{4}$ $2\frac{2}{5}$ — $\frac{1}{6} \div 4\frac{1}{6}$ $\frac{1}{25}$

10. $\frac{5}{8} \div \frac{1}{4}$ $2\frac{1}{2}$ — $1\frac{7}{8} \div 5$ $\frac{3}{8}$ — $1\frac{1}{8} \div 1\frac{4}{5}$ $\frac{5}{8}$ — $7 \div 2\frac{4}{5}$ $2\frac{1}{2}$

11. $\frac{3}{4} \div 9$ $\frac{1}{12}$ — $7\frac{1}{2} \div \frac{5}{6}$ 9 — $2\frac{5}{8} \div 1\frac{3}{4}$ $1\frac{1}{2}$ — $\frac{3}{4} \div 1\frac{1}{3}$ $\frac{9}{16}$

12. $6 \div \frac{3}{4}$ 8 — $8\frac{1}{4} \div 3$ $2\frac{3}{4}$ — $1\frac{4}{5} \div 18$ $\frac{1}{10}$ — $2 \div 5\frac{1}{3}$ $\frac{3}{8}$

13. $8 \div \frac{2}{5}$ 20 — $1\frac{3}{5} \div \frac{4}{5}$ 2 — $1\frac{2}{3} \div 10$ $\frac{1}{6}$ — $\frac{7}{8} \div 3\frac{1}{2}$ $\frac{1}{4}$

Divide and check:

14. $\begin{array}{r}47\\313\overline{)14711}\end{array}$ — $\begin{array}{r}29\frac{1}{27}\\729\overline{)21168}\end{array}$ — $\begin{array}{r}427\\179\overline{)76433}\end{array}$ — $\begin{array}{r}294\frac{1}{2}\\426\overline{)125457}\end{array}$

15. $\begin{array}{r}26\\681\overline{)17706}\end{array}$ — $\begin{array}{r}40\\572\overline{)22880}\end{array}$ — $\begin{array}{r}308\frac{1}{4}\\216\overline{)66582}\end{array}$ — $\begin{array}{r}480\\274\overline{)131520}\end{array}$

16. $\begin{array}{r}45\\495\overline{)22275}\end{array}$ — $\begin{array}{r}68\frac{10}{237}\\237\overline{)16126}\end{array}$ — $\begin{array}{r}37\\371\overline{)13727}\end{array}$ — $\begin{array}{r}467\\245\overline{)114415}\end{array}$

Use review as preparation for diagnostic test. Check papers carefully and note errors on progress cards. Group pupils who had mistakes to help them see causes and clear up difficulties. Let others work on decimal magic squares.

A Problem Test

1. How much change should you receive from a 10-dollar bill after purchasing $3\frac{1}{2}$ yd. of cloth at \$1.45 a yard? \$4.92
2. Joe can ride his bicycle at an average rate of 8 mi. per hour. What part of an hour will it take him to ride 6 mi.? $\frac{3}{4}$
3. In 1 hr. an airplane went 342 mi. while an automobile went only 38 mi. in the same time. How many times as fast as the car did the airplane go? 9
4. There are 36 pupils in Betty's class and 15 of them are girls. What part of the class is girls? $\frac{5}{12}$
5. Mrs. Wood paid 19¢ for a box of 4 lemons. Find the cost of 1 lemon at this price per box. $4\frac{3}{4}$¢
6. In the last 4 weeks Henry's hens have laid these numbers of eggs: $4\frac{1}{2}$ doz.; 5 doz.; $6\frac{1}{4}$ doz.; $4\frac{1}{4}$ doz. Find the average number of dozen eggs laid per week during this period. 5 doz.
7. Find the price of 1 doz. eggs if Henry charged Mrs. Gray 78¢ for $1\frac{1}{2}$ doz. eggs. 52¢
8. In making cocoa Sally uses 4 cups of milk for 6 cups of cocoa. If she wants to make 18 cups of cocoa, how many cups of milk should she use? 12
9. Mrs. Case has a dress pattern that calls for $4\frac{1}{4}$ yd. of material. She has a piece of material $3\frac{3}{4}$ yd. in length. How much too short is this piece? $\frac{1}{2}$ yd.
10. The 18 girls in the Glee Club are making their own costumes. Each costume takes $4\frac{1}{2}$ yd. of material. How much will the material for all the costumes cost at 79¢ a yard? \$63.99

How many problems did you get right? Look below to find out what your score means. Be sure pupils graph scores (see page 41)

SCORE	**0–5**	**6–7**	**8–9**	**10**
	You need help	**Fair**	**Good**	**Excellent**

Try to hold individual conferences with pupils who had mistakes to determine causes and help them clarify thinking about problem situations. Some pupils may need more help in recognizing which process should be used.

Present diagnostic test of skills taught in Chapter 5, with page references for remedial work.

How Much Have You Learned?

If you miss more than one example in a row, turn to the Practice Pages for that row.

Divide and check:

				Practice Pages
1.	$\overset{52}{342\overline{)17784}}$	$\overset{41\text{R}77}{450\overline{)18527}}$	$\overset{35}{534\overline{)18690}}$	165
2.	$\overset{67}{647\overline{)43349}}$	$\overset{84\text{R}81 \text{ or } 84\frac{1}{3}}{243\overline{)20493}}$	$\overset{59}{318\overline{)18762}}$	166
3.	$\overset{46\text{R}64 \text{ or } 46\frac{2}{9}}{288\overline{)13312}}$	$\overset{852}{193\overline{)164436}}$	$\overset{235\text{R}135 \text{ or } 235\frac{1}{5}}{675\overline{)158760}}$	168
4.	$\overset{680}{234\overline{)159120}}$	$\overset{304}{911\overline{)276944}}$	$\overset{6005}{791\overline{)4749955}}$	169

Divide. Check by going over the work:

5.	$8 \div \frac{1}{4}$ 32	$12 \div \frac{2}{3}$ 18	$10 \div \frac{4}{5}$ $12\frac{1}{2}$	172, 173
6.	$\frac{1}{5} \div \frac{1}{10}$ 2	$\frac{3}{8} \div \frac{1}{6}$ $2\frac{1}{4}$	$\frac{9}{16} \div \frac{3}{8}$ $1\frac{1}{2}$	174, 175
7.	$5\frac{1}{4} \div \frac{7}{8}$ 6	$1\frac{1}{6} \div \frac{2}{3}$ $1\frac{3}{4}$	$2\frac{1}{2} \div \frac{2}{5}$ $6\frac{1}{4}$	174, 175
8.	$\frac{5}{6} \div 4$ $\frac{5}{24}$	$\frac{9}{10} \div 3$ $\frac{3}{10}$	$\frac{2}{5} \div 4$ $\frac{1}{10}$	178
9.	$1\frac{1}{2} \div 6$ $\frac{1}{4}$	$5\frac{2}{5} \div 9$ $\frac{3}{5}$	$2\frac{1}{4} \div 9$ $\frac{1}{4}$	178
10.	$3 \div 1\frac{4}{5}$ $1\frac{2}{3}$	$8 \div 1\frac{1}{2}$ $5\frac{1}{3}$	$10 \div 4\frac{1}{6}$ $2\frac{2}{5}$	180, 181
11.	$7\frac{1}{2} \div 2\frac{1}{2}$ 3	$9\frac{3}{4} \div 3\frac{1}{4}$ 3	$3\frac{1}{4} \div 1\frac{1}{3}$ $2\frac{7}{16}$	180, 181
12.	$\frac{1}{3} \div 2\frac{2}{3}$ $\frac{1}{8}$	$\frac{1}{2} \div 2\frac{2}{3}$ $\frac{3}{16}$	$\frac{5}{8} \div 4\frac{1}{6}$ $\frac{3}{20}$	180, 181

Find the number to put in each space:

13.	4 is $\frac{1}{5}$ of . . 20	6 is $\frac{1}{2}$ of . . 12	20 is $\frac{1}{3}$ of . . 60	188
14.	8 is $\frac{2}{3}$ of . . 12	8 is $\frac{4}{5}$ of . . 10	15 is $\frac{3}{8}$ of . . 40	188
15.	24 in. is . . 6 times as long as 4 in.			184

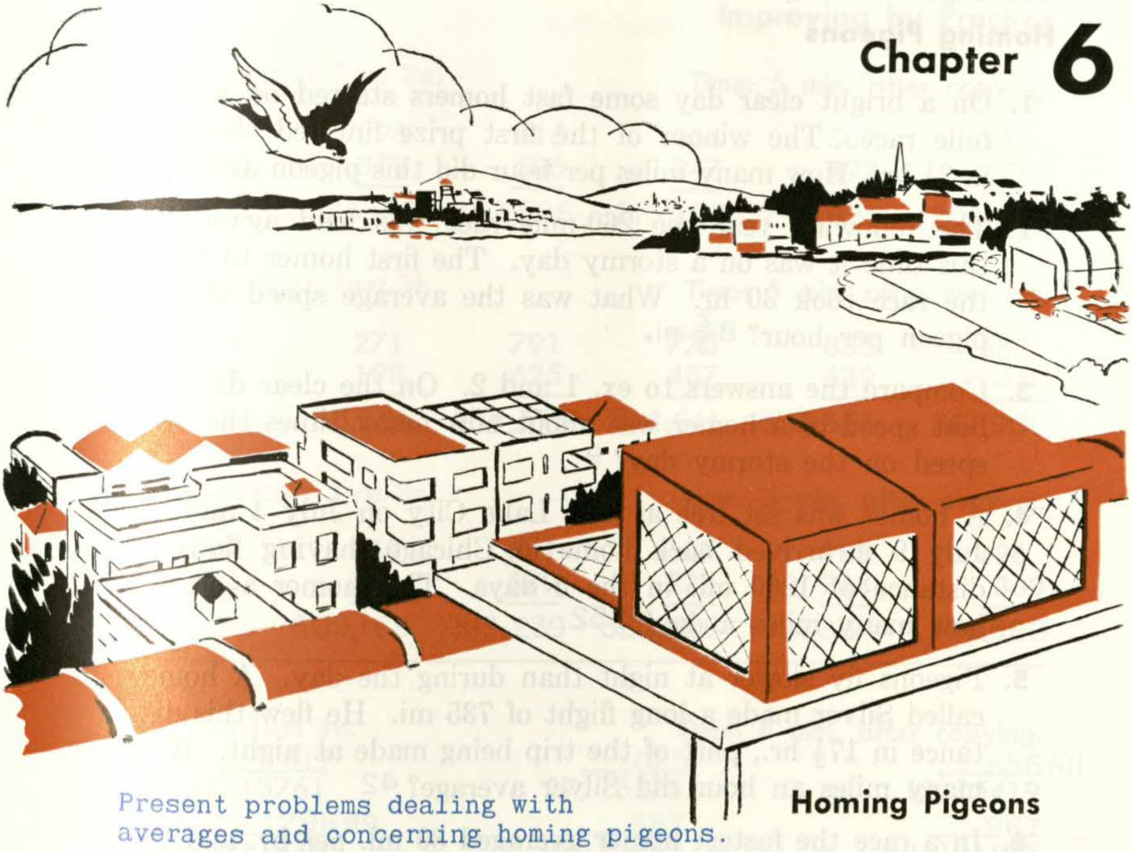
Find the fraction to put in each space:

16.	4 is . . $\frac{1}{3}$ of 12	2 is . . $\frac{1}{10}$ of 20	16 is . . $\frac{8}{9}$ of 18	186
17.	7 is . . $\frac{1}{4}$ of 28	3 is . . $\frac{1}{12}$ of 36	20 is . . $\frac{5}{6}$ of 24	186

It is important that pupils have good mastery and understanding of these skills before beginning new work. Have pupils explain their work so you may determine causes of difficulty. Assign remedial work after understanding is assured.

See G-77 for specific aims of Chapter 6.

Chapter 6



Present problems dealing with averages and concerning homing pigeons.

Homing Pigeons

Homing pigeons, called *homers* for short, are pigeons that can be trained to return home if set free in other places. The training of a homer begins when it is four weeks old, and by the time it is a year old it is ready to fly long distances. Homers are used for flying races and for carrying messages. A message is carried in a tiny container attached to the pigeon's leg.

1. When weather conditions are favorable a homer can fly at an average speed of about a mile a minute. How many miles an hour is this? 60

2. A homer flew 280 mi. in 5 hr. How many miles per hour did this pigeon fly? 56

3. A homer named Beauty made a flight of 500 mi. in 6 hr. 40 min. This was at the rate of how many miles an hour? 75

▶ First change 6 hr. 40 min. to $6\frac{2}{3}$ hr.

Since problems involve time-rate-distance applications, it may be necessary to review this first, using simple examples. Do problems as class activity, urging different pupils to explain their solutions.

Encourage pupils to investigate other facts concerning raising, training, and use of homing pigeons.

Homing Pigeons

1. On a bright clear day some fast homers started on a 260-mile race. The winner of the first prize finished the race in $3\frac{1}{4}$ hr. How many miles per hour did this pigeon average? 80

2. The following year the 260-mile race was held again but this time it was on a stormy day. The first homer to finish the race took 30 hr. What was the average speed of this pigeon per hour? $8\frac{2}{3}$ mi.

3. Compare the answers to ex. 1 and 2. On the clear day the best speed of a homer was about how many times the best speed on the stormy day? 9

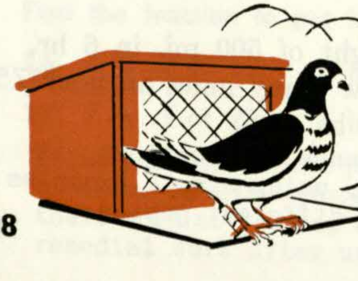
4. A homer was set free at Salt Lake City on July 4 and on July 9 it arrived back home in Chicago, having flown a distance of 1260 mi. in the 5 days. This homer averaged how many miles a day? 252

5. Pigeons fly slower at night than during the day. A homer called Silver made a long flight of 735 mi. He flew this distance in $17\frac{1}{2}$ hr., part of the trip being made at night. How many miles an hour did Silver average? 42

6. In a race the fastest homer averaged 80 mi. per hr. and the slowest homer averaged 32 mi. per hr. The fastest homer flew how many times as fast as the slowest homer? $2\frac{1}{2}$

7. The speed at which a homer flies is often given in **yards per minute.** For example, a homer that flies 1 mi. per minute is flying 1760 yd. per minute, since there are 1760 yd. in 1 mi. If a homer flies $1\frac{1}{4}$ mi. per minute, how many yards per minute does it fly? 2200

8. The fastest speed made by a homer in a race was 2917 yd. per minute. Is this about $1\frac{1}{2}$ mi. per minute or is it about $1\frac{3}{4}$ mi. per minute? $1\frac{3}{4}$



Present two more sets of improvement tests in multiplication and division.

Improving by Practice

Multiplication Test 3a. Time: 5 min. after copying.

1.	739	296	816	864	507	735	
	675	318	506	247	493	280	⑥
	498,825	94,128	412,896	213,408	249,951	205,800	

Multiplication Test 3b. Time: 5 min. after copying.

2.	496	271	791	773	835	582	
	387	198	625	407	639	450	⑥
	191,952	53,658	494,375	314,611	533,565	261,900	

Multiplication Test 3c. Time: 5 min. after copying.

3.	527	869	541	607	983	496	
	436	701	579	528	948	360	⑥
	229,772	609,169	313,239	320,496	931,884	178,560	

Division Test 3a. Time: 6 min. after copying.

4. $\begin{array}{r}417\\33\overline{)13761}\end{array}$ $\begin{array}{r}625\\27\overline{)16875}\end{array}$ $\begin{array}{r}856\text{R11}\\18\overline{)15419}\end{array}$

5. $\begin{array}{r}296\text{R9}\\40\overline{)11849}\end{array}$ $\begin{array}{r}487\\49\overline{)23863}\end{array}$ $\begin{array}{r}867\\25\overline{)21675}\end{array}$ ⑥

Division Test 3b. Time: 6 min. after copying.

6. $\begin{array}{r}485\\71\overline{)34435}\end{array}$ $\begin{array}{r}362\\50\overline{)18100}\end{array}$ $\begin{array}{r}539\\26\overline{)14014}\end{array}$

7. $\begin{array}{r}986\text{R5}\\16\overline{)15781}\end{array}$ $\begin{array}{r}714\\48\overline{)34272}\end{array}$ $\begin{array}{r}627\text{R13}\\34\overline{)21331}\end{array}$ ⑥

Division Test 3c. Time: 6 min. after copying.

8. $\begin{array}{r}684\\19\overline{)12996}\end{array}$ $\begin{array}{r}925\\30\overline{)27750}\end{array}$ $\begin{array}{r}376\text{R7}\\72\overline{)27079}\end{array}$

9. $\begin{array}{r}549\\35\overline{)19215}\end{array}$ $\begin{array}{r}863\text{R10}\\17\overline{)14681}\end{array}$ $\begin{array}{r}719\\58\overline{)41702}\end{array}$ ⑥

To the Teacher. In ex. 4–9, pupils should write R before remainders.

Emphasize importance of writing legibly, copying correctly, keeping figures in line in computations. Have pupils score and record results, noting improvements or further weaknesses as compared with previous tests (pages 74, 95, 139).

Teach how to divide decimals, other than dollars and cents, by whole numbers with exact decimals as quotients.

Dividing Decimals by Whole Numbers

1. Problem Mr. Clark paid \$12.60 for 3 books. What was the average cost per book? \$4.20

Explanation When you divide \$12.60 by 3, you are dividing a decimal by a whole number. The decimal point in the quotient is placed directly above the decimal point in \$12.60.

$$\overset{\$4.20}{3\overline{)\$12.60}}$$

2. Problem In 6 months 17.64 in. of rain fell in Newtown. What was the average number of inches that fell per month? 2.94

Explanation Divide 17.64 by 6 to find the average. You divide 17.64 just as you divide dollars and cents. Emphasize. It is important to place the first quotient figure in the proper position. In this case the 2 in the quotient is placed above the last figure of 17 because 17 was divided by 6 to get the first quotient figure. Place the decimal point in the quotient directly above the decimal point in the dividend.

$$\begin{array}{r} 2.94 \\ 6\overline{)17.64} \\ 12 \\ \hline 5\,6 \\ 5\,4 \\ \hline 24 \\ 24 \\ \hline \end{array}$$

The average rainfall per month was 2.94 in. Be sure pupils understand that 17 "ones," 56 "tenths," 24 "hundredths" were divided.

3. Work these exercises. Do you get the answers given?

$\overset{2.7}{3\overline{)8.1}}$ $\overset{.4}{7\overline{)2.8}}$ $\overset{.42}{4\overline{)1.68}}$ $\overset{.824}{2\overline{)1.648}}$ $\overset{.21}{23\overline{)4.83}}$

Have pupils explain any regrouping needed and position of quotients (dividing tenths gives tenths, and so on).

Divide. Check the work by multiplying:

4.	$\overset{3.2}{3\overline{)9.6}}$	$\overset{.151}{4\overline{).604}}$	$\overset{.73}{9\overline{)6.57}}$	$\overset{.319}{27\overline{)8.613}}$	$\overset{2.19}{32\overline{)70.08}}$
5.	$\overset{.12}{8\overline{).96}}$	$\overset{14.5}{5\overline{)72.5}}$	$\overset{.229}{4\overline{).916}}$	$\overset{9.8}{31\overline{)303.8}}$	$\overset{8.3}{67\overline{)556.1}}$
6.	$\overset{.9}{7\overline{)6.3}}$	$\overset{.119}{7\overline{).833}}$	$\overset{.249}{3\overline{).747}}$	$\overset{2.24}{42\overline{)94.08}}$	$\overset{.326}{29\overline{)9.454}}$
7.	$\overset{.17}{5\overline{).85}}$	$\overset{.32}{9\overline{)2.88}}$	$\overset{1.18}{8\overline{)9.44}}$	$\overset{7.3}{19\overline{)138.7}}$	$\overset{.57}{42\overline{)23.94}}$
8.	$\overset{2.4}{2\overline{)4.8}}$	$\overset{5.4}{8\overline{)43.2}}$	$\overset{7.2}{7\overline{)50.4}}$	$\overset{8.7}{56\overline{)487.2}}$	$\overset{.294}{21\overline{)6.174}}$
9.	$\overset{.13}{6\overline{).78}}$	$\overset{.75}{9\overline{)6.75}}$	$\overset{.137}{5\overline{).685}}$	$\overset{7.9}{23\overline{)181.7}}$	$\overset{14.7}{39\overline{)573.3}}$

More Practice. See ㊵ on page 322. Use to reinforce understanding.

Before doing page have pupils use materials to find answers to problems with no exchange ($2\overline{)2.6}$), then with exchange or regrouping ($2\overline{)1.2}$, $5\overline{)4.5}$). Have them explain why quotients must be less than one whole. Then do ex. 1–3 with pupils.

Teach how to avoid remainders in division by carrying quotient to more decimal places.

Taking Pictures

1. **Problem** Tom and three of his friends have bought a new camera that cost $35. If the 4 boys shared the cost equally, how much did each boy pay? $8.75

Explanation If you divide as shown at A, the quotient is $8\frac{3}{4}$. You can avoid the fraction $\frac{3}{4}$ by writing $35 as $35.00 before you divide, as shown at B; this gives $8.75 as the quotient. Each boy paid $8.75.

$$\begin{array}{cc} \text{A} & \text{B} \\ \begin{array}{r}\$8\frac{3}{4}\\ 4\overline{)\$35}\end{array} & \begin{array}{r}\$8.75\\ 4\overline{)\$35.00}\end{array}\end{array}$$

2. **Problem** Tom's father has promised to drive the boys to Mount Washington next fall to take color pictures. Tom's father can make this trip of 145 mi. in 4 hr. Find his average speed on this trip. 36.25 mi. per hour

Explanation If you divide 145 by 4, you get $36\frac{1}{4}$. You can avoid a remainder by writing 145 as 145.00 before you divide. The quotient is 36.25, so Tom's father averages 36.25 mi. per hour on this trip.

$$\begin{array}{r}36.25\\ 4\overline{)145.00}\end{array}$$

Practice Exercises. See ㊶ on page 323. Use for further teaching, stressing understandings.

Emphasize after demonstration.

To avoid remainders in division, annex zeros after the decimal point of the dividend and continue to divide.

Have pupils use materials to discover above boxed statement in finding solutions to simple problems ($4\overline{)5}$). Be sure they see regrouping needed (1 = 10 tenths, 2 tenths = 20 hundredths) and that value of numbers has not changed.

Avoiding Remainders

1. **Problem** Lucy helped her mother make new curtains. They made 8 pairs of curtains at a cost of \$23. Find the cost of 1 pair of curtains. \$2.875

Explanation If you annex 2 zeros to \$23, as shown at A, you get an answer of \$2.87½. The work may also be done by annexing 3 zeros to \$23, as shown at B. In this way you avoid a remainder and the answer is \$2.875. You learned on page 136 that \$2.87½ is another way of writing \$2.875, so the two answers are equal.

A

$$\begin{array}{r} \$2.87\tfrac{1}{2} \\ 8\overline{)\$23.00} \\ 16 \\ \hline 70 \\ 64 \\ \hline 60 \\ 56 \\ \hline 4 \end{array}$$

B

$$\begin{array}{r} \$2.875 \\ 8\overline{)\$23.000} \\ 16 \\ \hline 70 \\ 64 \\ \hline 60 \\ 56 \\ \hline 40 \\ 40 \\ \hline \end{array}$$

In these problems first divide, expressing each quotient with a fraction. Then work the problem again by annexing enough zeros to the dividend to make the division come out with no remainder:

2. Mr. King drove his car 153 mi. in 4 hr. How many miles did he average per hour? $38\frac{1}{4}$; 38.25

3. Mr. York hauled 76 tons of sand in 16 loads. How many tons was that per load? $4\frac{3}{4}$; 4.75

4. Mr. Hill paid \$62 for 16 fountain pens to sell in his store. What was the cost of 1 fountain pen? \$$3.87\frac{1}{2}$; \$3.875

5. A speed of 255 mi. an hour is how many miles per minute? $4\frac{1}{4}$; 4.25

6. An airplane goes 345 mi. an hour. How many miles per minute does this plane go? $5\frac{3}{4}$; 5.75

7. At a sale Henry paid \$7.50 for 4 books. Find the average cost of 1 book. In this example annex one zero to \$7.50 to avoid a remainder. \$$1.87\frac{1}{2}$; \$1.875

8. Mrs. Clark bought 1 doz. rose bushes for \$18.30. Find the average cost of 1 rose bush. \$$1.52\frac{1}{2}$; \$1.525

More Practice. See ㊷ on page 323.

In discussing ex. 1, be sure pupils understand that annexing zeros "after the decimal point" does not change value of the numbers. Do 2–4 with pupils, letting volunteers explain regrouping involved. Then have pupils complete ex. 5–8.

Decimals in the Quotient

Divide. **Place a decimal point after the dividend and annex enough 0's to avoid a remainder. Check the work:**

1.	$\begin{array}{r}4.25\\4\overline{)17.00}\end{array}$	$\begin{array}{r}8.5\\12\overline{)102.0}\end{array}$	$\begin{array}{r}8.25\\16\overline{)132.00}\end{array}$	$\begin{array}{r}9.44\\25\overline{)236.00}\end{array}$	$\begin{array}{r}11.25\\12\overline{)135.00}\end{array}$
2.	$\begin{array}{r}2.5\\6\overline{)15.0}\end{array}$	$\begin{array}{r}9.2\\25\overline{)230.0}\end{array}$	$\begin{array}{r}6.5\\24\overline{)156.0}\end{array}$	$\begin{array}{r}5.5\\36\overline{)198.0}\end{array}$	$\begin{array}{r}6.28\\25\overline{)157.00}\end{array}$
3.	$\begin{array}{r}6.75\\8\overline{)54.00}\end{array}$	$\begin{array}{r}6.25\\32\overline{)200.00}\end{array}$	$\begin{array}{r}2.5\\84\overline{)210.0}\end{array}$	$\begin{array}{r}8.5\\32\overline{)272.0}\end{array}$	$\begin{array}{r}10.6\\25\overline{)265.0}\end{array}$
4.	$\begin{array}{r}13.5\\2\overline{)27.0}\end{array}$	$\begin{array}{r}7.4\\75\overline{)555.0}\end{array}$	$\begin{array}{r}1.75\\64\overline{)112.00}\end{array}$	$\begin{array}{r}7.625\\16\overline{)122.000}\end{array}$	$\begin{array}{r}7.5\\34\overline{)255.0}\end{array}$
5.	$\begin{array}{r}4.125\\8\overline{)33.000}\end{array}$	$\begin{array}{r}8.25\\28\overline{)231.00}\end{array}$	$\begin{array}{r}5.24\\25\overline{)131.00}\end{array}$	$\begin{array}{r}6.125\\56\overline{)343.000}\end{array}$	$\begin{array}{r}4.36\\75\overline{)327.00}\end{array}$
6.	$\begin{array}{r}9.25\\4\overline{)37.00}\end{array}$	$\begin{array}{r}9.75\\12\overline{)117.00}\end{array}$	$\begin{array}{r}10.25\\44\overline{)451.00}\end{array}$	$\begin{array}{r}7.25\\28\overline{)203.00}\end{array}$	$\begin{array}{r}6.8\\45\overline{)306.0}\end{array}$

7. Study these examples carefully:

$$\begin{array}{r}.75\\4\overline{)3.00}\\\underline{2\,8}\\20\\\underline{20}\end{array}\qquad\begin{array}{r}.25\\36\overline{)9.00}\\\underline{7\,2}\\1\,80\\\underline{1\,80}\end{array}\qquad\begin{array}{r}.875\\16\overline{)14.000}\\\underline{12\,8}\\1\,20\\\underline{1\,12}\\80\\\underline{80}\end{array}\qquad\begin{array}{r}.75\\216\overline{)162.00}\\\underline{151\,2}\\10\,80\\\underline{10\,80}\end{array}$$

8. A school paid \$441 for 450 music books. What was the cost of 1 book? If they paid \$273 for 364 spelling books, what was the cost of 1 spelling book? \$.75

\$.98

Divide, annexing enough 0's to the dividend to make the division come out with no remainder. Check your work:

9.	$\begin{array}{r}.5\\4\overline{)2.0}\end{array}$	$\begin{array}{r}.76\\25\overline{)19.00}\end{array}$	$\begin{array}{r}.625\\24\overline{)15.000}\end{array}$	$\begin{array}{r}.48\\75\overline{)36.00}\end{array}$	$\begin{array}{r}1.35\\52\overline{)70.20}\end{array}$
10.	$\begin{array}{r}.6\\5\overline{)3.0}\end{array}$	$\begin{array}{r}.125\\96\overline{)12.000}\end{array}$	$\begin{array}{r}.68\\25\overline{)17.00}\end{array}$	$\begin{array}{r}.375\\72\overline{)27.000}\end{array}$	$\begin{array}{r}1.175\\28\overline{)32.900}\end{array}$
11.	$\begin{array}{r}.625\\8\overline{)5.000}\end{array}$	$\begin{array}{r}.5\\44\overline{)22.0}\end{array}$	$\begin{array}{r}.25\\64\overline{)16.00}\end{array}$	$\begin{array}{r}.84\\25\overline{)21.00}\end{array}$	$\begin{array}{r}1.22\\25\overline{)30.50}\end{array}$
12.	$\begin{array}{r}.875\\8\overline{)7.000}\end{array}$	$\begin{array}{r}.52\\75\overline{)39.00}\end{array}$	$\begin{array}{r}.75\\92\overline{)69.00}\end{array}$	$\begin{array}{r}.775\\40\overline{)31.000}\end{array}$	$\begin{array}{r}1.476\\25\overline{)36.900}\end{array}$

More Practice. See ㊹ on page 324. Use for remedial activities.

Be sure that pupils do not have just mechanical mastery of skill. Group pupils who show lack of understanding (from explanations of their answers) for further teaching (use place pocket chart and materials).

Present completion test involving special vocabulary and understandings.

The Language of Arithmetic

In the sentences below give the correct word to put in each space. Do not write in the spaces:

1. When you change $\frac{7}{8}$ to $\frac{8}{7}$, you invert the fraction.

2. When you multiply two fractions, you multiply the numerators and then multiply the denominators.

3. To divide by a fraction, invert the divisor and multiply.

4. In the decimal .427, the 4 stands for tenths, the 2 stands for hundredths, and the 7 stands for thousandths.

5. A number is divisible by 9 if the sum of its figures is divisible by 9.

6. To find the area of a rectangle, multiply the length by the width.

7. A small piece of land is measured by the square foot or the square yard. A larger piece of land is measured by the acre.

8. There are as many decimal places in a product as there are decimal places in the multiplier and the multiplicand together.

9. In a magic square all the rows, columns, and diagonals have the same sum.

10. To find what part one number is of a larger number, write the smaller number over the larger number to make a fraction.

11. To find how many times as large one number is as another, divide the larger number by the smaller number.

12. The number 47.83, which consists of a whole number and a decimal, is called a mixed decimal.

13. When you find the area of a rectangle, you must express both dimensions of the rectangle in the same unit of measure.

14. When you say that 168,925,304 is about 169,000,000, you have rounded off 168,925,304 to the nearest million.

Some pupils may need to have understanding redeveloped, as shown by results of test. If they need help with vocabulary have them make study cards for own use (see page 99).

Present problems dealing with raising of corn.

Record Corn Crops

1. In a recent year a record crop of corn in a certain state was 173.4 bu. per acre. At this rate, how many bushels of corn would be produced on a field of 10 acres? 1734 on a field of 21.9 acres? 3797.46 on a field of 14.3 acres? 2479.62

2. In a state corn-growing contest each of the contestants planted 5 acres. The total yields on the 5-acre fields of these contestants were as follows:

John Wood, 863.5 bu. (1)	Jim Johnson, 821.5 bu. (3)
Fred Brown, 852.0 bu. (2)	Paul Lewis, 803.6 bu. (4)

What was the average number of bushels produced per acre by each contestant? (1)172.7; (2)170.4; (3)164.3; (4)160.72

3. In another state corn-growing contest each contestant planted 10 acres. The total yields on the 10-acre fields of four contestants were: 1803.0 bu.; (1) 1614.6 bu.; (2) 1593.2 bu.; (3) 1427.9 bu. (4) What was the average number of bushels produced per acre by each contestant? (1)180.3; (2)161.46; (3)159.32; (4)142.79

4. On a 34-acre field one farmer produced 3542.8 bu. of corn. What was the average yield per acre? 104.2 bu. At that rate, how many bushels would he produce on a field of 47.5 acres? 4949.5

5. On a 5-acre field Henry Clark produced a total of 563 bu. of corn. How many bushels did he average per acre? 112.6 At $1.65 per bushel, find the value of the corn produced on this field. $928.95 At $1.80 per bushel, find the value. $1013.40

Note correlation of examples with geography and farming. Refer to a geography, or farm experiences of pupils, as background for problems. Develop understanding of phrases, "yield of an acre," and "10-acre yield of 1803.0 bu."

Problems without Questions

Make a good question for each problem so that all the numbers in the problem are used. Then find the answer to your question:

1. The distance from Westport to Lakewood by the new highway is 14.9 mi. The distance by the old road that goes along the lake is 17.2 mi.

2. Peggy can work 2 arithmetic problems in 3 min. She has 10 problems to do.

3. In the school lunchroom George spent \$.27 on Monday, \$.28 on Tuesday, \$.22 on Wednesday, \$.32 on Thursday, and \$.26 on Friday.

4. George pays for his school lunches out of his weekly allowance of \$2.00. See ex. 3.

5. Jim had to change trains at St. Louis and expected to wait $2\frac{1}{4}$ hr. between trains. The train to St. Louis was 40 min. late but the train that left St. Louis was on time.

6. A 2-pound brick of cheese costs \$1.07. The same kind of cheese is sold in $\frac{1}{2}$-pound packages at 30¢ each.

7. In his stamp collection Peter has 104 stamps from South America and 137 stamps from European countries. He has as many United States stamps as the South American and European stamps together.

8. Frank's garden is 15 ft. by 15 ft. and Henry's garden is 12 ft. by 20 ft.

9. Mary plans to make a knit blanket 72 in. long and 48 in. wide by sewing together knit squares. Each knit square measures 6 in. by 6 in.

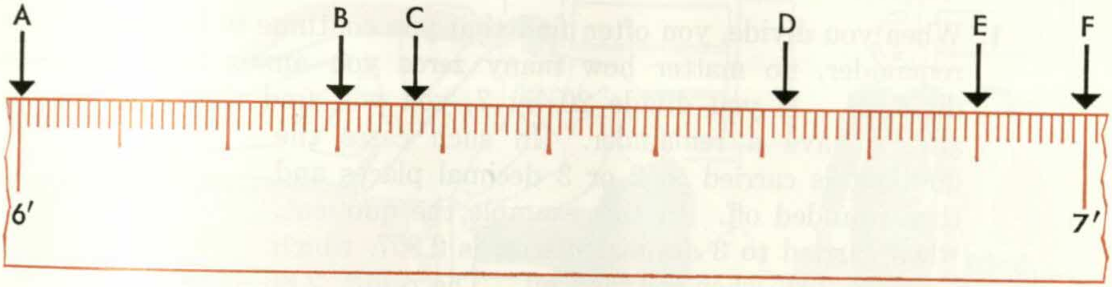
10. Ann mailed a package that held a sweater weighing 13 oz., a pair of gloves weighing 3 oz., and a blouse weighing 6 oz. The package weighed 1 lb. 13 oz.

11. William is saving money for camp next summer. He needs \$85 to stay 4 weeks.

Evaluate thinking ability of pupils through questions they suggest. Urge class to critically evaluate the questions as to sensibility and probability. Have class solve the problems using the different questions.

Teach rule for rounding off decimals and apply it in rounding off quotients in division (pages 207-208).

Rounding off Decimals



1. The drawing above shows, reduced in size, a piece of a measuring tape on which each foot is divided into 100 equal parts. **A** represents 6 ft., **B** represents 6.3 ft., and **C** represents 6.37 ft.

2. **A** also represents 6.0 ft. and 6.00 ft. 6.0 ft. means 6 and no tenths ft. What does 6.00 ft. mean? **B** also represents 6.30 ft., which means 6 and 30 hundredths ft. What do **D, E,** and **F** represent? 6.72; 6.9 or 6.90; 7, 7.0, or 7.00

3. If 6.72 is the answer to a problem, you sometimes drop the 2 and call the answer 6.7. When you do this you have **rounded off** 6.72 to the **nearest tenth.** You can see in the drawing above that 6.72 is closer to 6.70 than to 6.80.

4. If you **round off** 6.37 to the **nearest tenth,** you drop the 7 and **make the figure before it one larger,** getting 6.4. As seen above, 6.37 is closer to 6.40 than to 6.30.

5. When 6.85 is rounded off to the nearest tenth, the answer usually given is 6.9. As you can see, 6.85 is halfway between 6.80 and 6.90. In such cases select the **larger** number when rounding off. Round off to the nearest tenth: 4.78, 7.35, 5.83. 5.8 4.8 7.4

6. Decimals having 3 places are sometimes rounded off to the **nearest hundredth.** For example, 5.713 is rounded off to 5.71 because 5.713 is closer to 5.710 than to 5.720. Likewise, 5.716 is rounded off to 5.72 because it is closer to 5.720 than to 5.710. When you round off 5.715, it becomes 5.72.

First review rounding off numbers, introduced on page 27. Then follow development as given. Emphasize that decimal is expressed to one more decimal place than will be retained in the answer.

Rounding Off Results

1. When you divide, you often find that you continue to have a remainder, no matter how many zeros you annex to the dividend. If you divide 20 by 7, you will find that you always have a remainder. In such cases the quotient is carried to 2 or 3 decimal places and then rounded off. In this example the quotient, when carried to 3 decimal places, is 2.857, which becomes 2.86 when rounded off. The result, 2.86, is said to be **correct** to the nearest hundredth.

$\overset{2.857}{7\overline{)20.000}}$

Be sure pupils understand meaning of "correct" to nearest hundredth.

2. Round off each decimal correct to the nearest tenth:
$\overset{4.7}{4.71}$, .53, .5 $\overset{7.3}{7.29}$, $\overset{4.9}{4.89}$, $\overset{2.1}{2.07}$, $\overset{9.0}{8.98}$, .65, .7 $\overset{3.5}{3.51}$, 2.96 3.0

3. Round off each decimal correct to the nearest hundredth:
$\overset{5.28}{5.283}$, $\overset{7.92}{7.924}$, $\overset{3.22}{3.219}$, .907, .91 $\overset{6.39}{6.385}$, $\overset{8.40}{8.396}$, .295 .30

In ex. 4-12 only final answers are shown (rounded off).

Divide. Carry the quotient to two decimal places; then round off the result correct to the nearest tenth: Have pupils explain work.

4. $\overset{5.3}{7\overline{)37}}$ $\overset{9.6}{8\overline{)77}}$ $\overset{.3}{6\overline{)1.93}}$ $\overset{4.2}{28\overline{)117}}$ $\overset{.4}{45\overline{)19.9}}$ $\overset{.8}{31\overline{)25.7}}$

5. $\overset{3.2}{9\overline{)29}}$ $\overset{8.8}{6\overline{)53}}$ $\overset{9.7}{4\overline{)38.7}}$ $\overset{8.4}{43\overline{)362}}$ $\overset{.2}{24\overline{)4.52}}$ $\overset{.2}{23\overline{)4.89}}$

6. $\overset{7.2}{6\overline{)43}}$ $\overset{7.7}{7\overline{)54}}$ $\overset{1.4}{9\overline{)12.2}}$ $\overset{6.8}{19\overline{)129}}$ $\overset{.3}{39\overline{)9.77}}$ $\overset{.2}{46\overline{)7.75}}$

7. $\overset{19.3}{3\overline{)58}}$ $\overset{9.8}{9\overline{)88}}$ $\overset{.5}{8\overline{)4.19}}$ $\overset{3.8}{58\overline{)221}}$ $\overset{.7}{77\overline{)53.5}}$ $\overset{.8}{52\overline{)39.9}}$

Divide. Carry the quotient to three decimal places; then round off the result correct to the nearest hundredth: Have pupils explain work.

8. $\overset{8.17}{6\overline{)49}}$ $\overset{5.56}{9\overline{)50}}$ $\overset{.15}{3\overline{).46}}$ $\overset{.12}{7\overline{).816}}$ $\overset{1.44}{45\overline{)64.93}}$ $\overset{1.49}{36\overline{)53.77}}$

9. $\overset{1.86}{7\overline{)13}}$ $\overset{2.88}{8\overline{)23}}$ $\overset{.10}{9\overline{).94}}$ $\overset{.18}{4\overline{).729}}$ $\overset{.17}{33\overline{)5.628}}$ $\overset{.12}{28\overline{)3.264}}$

10. $\overset{7.67}{3\overline{)23}}$ $\overset{14.17}{6\overline{)85}}$ $\overset{.14}{6\overline{).83}}$ $\overset{.33}{9\overline{)2.94}}$ $\overset{.68}{42\overline{)28.36}}$ $\overset{.76}{35\overline{)26.43}}$

11. $\overset{3.63}{8\overline{)29}}$ $\overset{8.43}{7\overline{)59}}$ $\overset{.12}{8\overline{).95}}$ $\overset{.87}{8\overline{)6.94}}$ $\overset{.11}{19\overline{)2.007}}$ $\overset{.15}{41\overline{)6.215}}$

12. $\overset{11.83}{6\overline{)71}}$ $\overset{27.33}{3\overline{)82}}$ $\overset{.04}{9\overline{).35}}$ $\overset{.47}{6\overline{)2.83}}$ $\overset{.31}{27\overline{)8.361}}$ $\overset{.30}{32\overline{)9.467}}$

Discuss ex. 1 carefully with pupils, emphasizing that quotient is carried to one more place than is wanted in answer. Do ex. 2-3 as class activity. Then have pupils complete ex. 4-12 independently.

Review how to find average (arithmetic mean) when decimal fractions are involved. Review meaning of "per."

Using an Automobile

1. Jim's father keeps a record of all of the gasoline that he buys for his car. Last year he used 512 gal. of gasoline and drove the car 7875 mi. Find, to the nearest tenth of a mile, the number of miles he averaged per gallon of gasoline. 15.4

2. The total cost of the 512 gal. of gasoline was $136.19. Find the average cost of the gasoline per gallon, correct to the nearest cent. $.27

3. On long trips Jim's father usually averages 35 mi. per hour. At that rate how many hours does he need to drive 268 mi.? Find the result to the nearest tenth of an hour. 7.7

4. The best time that Jim's father has ever made on a trip was when he drove a distance of 334 mi. in 8 hr. What was his average speed in miles per hour? Find the result to the nearest tenth of a mile. 41.8

5. When Jim and his parents took a 7-day trip, they drove a total of 1973 mi. Find the average number of miles they drove per day, correct to the nearest mile. 282

Do problems with class, letting different pupils explain their solutions at board. Make up few more problems for pupils to solve independently. Some pupils may wish to keep record of family car costs and then make up problems for class to solve.

Teach how to change common fractions to exact decimals or incomplete decimals (pages 210-211).

Changing Fractions to Decimals

1. **Problem** Bob paid \$1 for 4 handkerchiefs. How much did 1 handkerchief cost? \$.25

Explanation If you divide \$1 by 4, you get $\$\frac{1}{4}$ since $\frac{1}{4}$ means $1 \div 4$. So each handkerchief cost $\$\frac{1}{4}$. Another way to work the problem is to write \$1.00 and then divide by 4, which gives \$.25. So $\frac{1}{4} = .25$.

$$4\overline{)\$1.00}^{\;\$.25}$$

2. **Problem** Ellen's mother bought 8 yd. of material for \$5. What was the cost of 1 yd.? \$.625

Explanation Each yard costs $\$\frac{5}{8}$. If you write a decimal point after \$5 and annex 2 zeros, the quotient is $\$.62\frac{1}{2}$. If you annex 3 zeros, you get \$.625. So $\frac{5}{8} = .62\frac{1}{2}$, or .625.

$$8\overline{)\$5.00}^{\;\$.62\frac{1}{2}} \qquad 8\overline{)\$5.000}^{\;\$.625}$$

Emphasize "after" understanding is assured.

To change a common fraction to a decimal, put a decimal point after the numerator, annex zeros, and divide by the denominator.

Change these fractions to decimals:

3. $\frac{1}{5}$ .2 $\frac{3}{4}$ .75 $\frac{1}{2}$ .5 $\frac{4}{5}$ .8 $\frac{9}{20}$ .45 $\frac{7}{10}$ .7 $\frac{8}{25}$ .32 $\frac{3}{20}$ .15 $\frac{2}{5}$ .4 $\frac{17}{25}$ .68 $\frac{3}{10}$ .3

4. $\frac{1}{8}$ .125 $\frac{3}{8}$ .375 $\frac{7}{8}$ .875 $\frac{3}{5}$ .6 $\frac{13}{20}$ .65 $\frac{4}{25}$ .16 $\frac{9}{10}$ .9 $\frac{17}{20}$ .85 $\frac{5}{8}$ .625 $\frac{11}{20}$ .55 $\frac{9}{25}$ .36

Point out usefulness of changing fraction to decimal for comparison purposes.

Tell which one is larger. First change the fraction to a decimal:

5. $\frac{3}{8}$ or .394 .394 $\frac{3}{5}$ or .58 $\frac{3}{5}$ $\frac{3}{10}$ or .32 .32 $\frac{24}{25}$ or .95 $\frac{24}{25}$ $\frac{9}{20}$ or .44 $\frac{9}{20}$

6. $\frac{3}{4}$ or .72 $\frac{3}{4}$ $\frac{7}{8}$ or .842 $\frac{7}{8}$ $\frac{4}{25}$ or .15 $\frac{4}{25}$ $\frac{2}{5}$ or .43 .43 $\frac{13}{25}$ or .50 $\frac{13}{25}$

7. Remember the decimal values of these fractions: Following should be memorized "after" understanding is assured.

$\frac{1}{4} = .25$ $\frac{3}{4} = .75$ $\frac{1}{8} = .125$ $\frac{5}{8} = .625$

$\frac{1}{2} = .50$ $1 = 1.00$ $\frac{3}{8} = .375$ $\frac{7}{8} = .875$

Follow development as given, emphasizing that value of figures is not changed by annexing zeros after decimal point. Be sure pupils understand the regrouping involved (1 = 10 tenths, 2 tenths = 20 hundredths).

Make class chart of fractions and decimal equivalents, given on pages 210 (ex. 7) and 211 (ex. 3).

Changing Fractions to Decimals

1. **Problem** Change $\frac{2}{3}$ to a decimal.

Explanation To change $\frac{2}{3}$ to a decimal, you first annex zeros to 2 and then divide by 3. If you annex 1 zero, you get $.6\frac{2}{3}$; if you annex 2 zeros, you get $.66\frac{2}{3}$; if you annex 3 zeros, you get $.666\frac{2}{3}$. No matter how many zeros you annex to 2, you always get a remainder. So $\frac{2}{3} = .6\frac{2}{3}$, or $.66\frac{2}{3}$, or $.666\frac{2}{3}$.*

$$\overset{.6\frac{2}{3}}{3\overline{)2.0}} \qquad \overset{.66\frac{2}{3}}{3\overline{)2.00}} \qquad \overset{.666\frac{2}{3}}{3\overline{)2.000}}$$

Change to decimals with two places: Do ex. 2 as class activity.

2. $\frac{1}{3}$ .33 $\frac{5}{6}$ .83 $\frac{1}{7}$ .14 $\frac{4}{9}$ .44 $\frac{6}{7}$ .85 $\frac{1}{6}$ .16 $\frac{2}{9}$ .22 $\frac{8}{9}$ .88 $\frac{5}{12}$ .41 $\frac{3}{11}$ .27 $\frac{11}{15}$ .73

3. Remember the decimal values of these fractions: Following should be memorized "after" understanding is assured.

$\frac{1}{3} = .33\frac{1}{3}$ $\quad$ $\frac{2}{3} = .66\frac{2}{3}$ $\quad$ $\frac{1}{6} = .16\frac{2}{3}$ $\quad$ $\frac{5}{6} = .83\frac{1}{3}$

4. **Problem** Change $\frac{1}{6}$ to a decimal correct to the nearest hundredth. .17

Explanation When you change $\frac{1}{6}$ to a three-place decimal, you get .166 with a remainder of 4. If you round off .166 to the nearest hundredth, you get .17. So $\frac{1}{6} = .17$, to the nearest hundredth.

$$\overset{.166}{6\overline{)1.000}}$$

.17 Ans.

When you change a fraction to a decimal, carry the work to one more decimal place than you need in the answer. Stress. Then round off the result.

Ex. 5-6 should be done independently. Check pupils as they work to note difficulties.

Change to decimals correct to the nearest hundredth:

5. $\frac{5}{6}$ .83 $\frac{3}{7}$ .43 $\frac{1}{9}$ .11 $\frac{1}{3}$ .33 $\frac{4}{11}$ .36 $\frac{5}{7}$ .71 $\frac{5}{9}$ .56 $\frac{9}{13}$ .69 $\frac{7}{12}$ .58 $\frac{4}{17}$ .24 $\frac{11}{19}$ .58

Change to mixed decimals, correct to the nearest hundredth:

8.67 1.86 5.89 7.57 3.33 4.17 2.14 4.29 6.44

6. $8\frac{2}{3}$ $1\frac{6}{7}$ $5\frac{8}{9}$ $7\frac{4}{7}$ $3\frac{1}{3}$ $4\frac{1}{6}$ $2\frac{1}{7}$ $4\frac{2}{7}$ $6\frac{4}{9}$ $8\frac{5}{6}$ 8.83

More Practice. See ㊸ on page 323. Use to reinforce skill.

*Point out to pupils that plus sign is often used (instead of writing the common fraction) in writing decimal fraction to indicate that remainder still exists. Explanations in ex. 1 and 4 should be discussed carefully.

Present problems involving mixed decimal numbers. Have pupils note uses of decimals in everyday life.

Decimals in Problems

1. A 70-story building in New York City is 850 ft. high. What is the average height per story? Find the answer correct to the nearest tenth of a foot. 12.1

2. The distance from Boston to St. Louis is 1205 mi. by one automobile route. Mr. Lewis made this trip in 37 hr. of actual driving. How many miles, on the average, did he drive per hour? Find the result to the nearest tenth of a mile. 32.6

3. Mr. Case wants to drive from New York to San Francisco next year. He finds the distance by one route is 3173 mi. If he usually averages about 35 mi. per hour on long trips, how many hours of actual driving will the trip take? Find the result correct to the nearest tenth of an hour. 90.7

4. The airline distance between Salt Lake City and St. Louis is 1162 mi. If an airplane travels at an average speed of 235 mi. per hour, how long will the trip take? Find the result correct to the nearest tenth of an hour. 4.9

5. After a big snowstorm these five measurements of the amount of snow were made: 9.8 in., 9.9 in., 9.6 in., 9.7 in., 9.9 in. Find the average snowfall to the nearest tenth of an inch. 9.8

6. In a northern town the snowfall for each of 4 months was: 7.5 in., 8.4 in., 11.3 in., 9.3 in. Find, to the nearest tenth of an inch, the average snowfall per month. 9.1

7. The amount of rain that fell in Westport during these months was as follows: April, 3.72 in.; May, 4.84 in.; June, 6.19 in.; July, 5.72 in. Find, to the nearest hundredth of an inch, the average rainfall per month. 5.12

8. One year the total rainfall in Newtown was 52.71 in. Find, to the nearest hundredth of an inch, the average rainfall per month. 4.39

9. On a special run a train traveled 95 mi. in 71 min. Find its speed in miles per minute. Carry the result to three decimal places; (1.338) then round it off to the nearest hundredth of a mile. 1.34

Instruct pupils to read problems carefully to determine what the problem asks, facts known, process or processes to use, how to write it in numerical form. Try to determine if problem situations, rounding off decimals, and so on, cause difficulty.

Present another set of improvement tests in addition. Review some skills in decimal and common fractions.

Improving by Practice

Addition Test 4a. Time: 4 min.

1.	1264	4480	8755	6343	4205
	3913	1039	5579	1395	8997
	6854	7773	6264	9669	3731
	9732	7643	2603	2855	6582
	2278	4852	5015	8079	6535
	4121	2367	4631	1734	2618 ⑤
	28,162	28,154	32,847	30,075	32,668

Addition Test 4b. Time: 4 min.

2.	6343	3657	4048	1741	5571
	4866	5615	9889	7599	1303
	3484	5724	3940	8125	9069
	2737	4005	1226	1622	2286
	7596	7840	9789	2782	6290
	4129	3159	6518	8167	1908 ⑤
	29,155	30,000	35,410	30,036	26,427

Addition Test 4c. Time: 4 min.

3.	5286	9971	7805	2888	1719
	3335	3348	4806	8919	5832
	2768	8946	5367	1992	9564
	3447	2875	5440	7069	7250
	4743	9694	1275	3162	7611
	7458	8026	5237	4511	5654 ⑤
	27,037	42,860	29,930	28,541	37,630

Review Practice

Use results of review to plan for reteaching or remedial work.

4. **Multiply by .6:** 23 13.8 .75 .450 .09 .054 460 276.0 13.8 8.28

5. **Divide by 5:** 1.2 .24 231 46.2 42.8 8.56 1.45 .29 34.2 6.84

6. **Find $\frac{2}{3}$ of each:** 9 6 11 $7\frac{1}{3}$ $3\frac{1}{2}$ $2\frac{1}{3}$ $\frac{15}{16}$ $\frac{5}{8}$ $1\frac{1}{2}$ 1

7. **Divide by $1\frac{1}{2}$:** 8 $5\frac{1}{3}$ 24 16 $\frac{9}{10}$ $\frac{3}{5}$ $7\frac{1}{2}$ 5 $1\frac{1}{8}$ $\frac{3}{4}$

8. **Multiply by $1\frac{1}{3}$:** 15 20 10 $13\frac{1}{3}$ $\frac{9}{10}$ $1\frac{1}{5}$ $4\frac{1}{2}$ 6 $7\frac{1}{2}$ 10

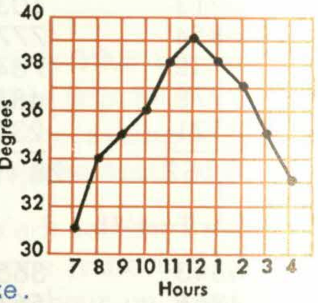
More Practice. See ㊺ on page 324.

See pages 54-58, 107, and 167 for directions and suggestions for giving, scoring, and recording results of tests. Through individual conferences, try to determine causes of errors before assigning remedial work.

Teach the making, drawing, and reading of line graphs (pages 214–215). Review meaning of vertical and horizontal.

Line Graphs

1. You have learned how to make a line graph to show the changes in your scores on Improvement Tests. A line graph is often used to show how the temperature changes from hour to hour during the day. The graph at the right is such a line graph. You see two scales, the **vertical** scale marked in **degrees of temperature** and the **horizontal** scale marked in **hours of the day.** In reading a line graph you need to use both scales. Emphasize.



2. At 7 A.M. the temperature was 31°. You see a dot on the vertical line above 7 and on the horizontal line for 31. At 8 A.M. the temperature was 34°. From the graph tell the temperature for each of the other hours of the day to 4 P.M. 9 A.M. 35°; 10 A.M., 36°; 11 A.M., 38°; 12 M., 39°; 1 P.M., 38°; 2 P.M., 37°; 3 P.M., 35°; 4 P.M., 33°

3. At what hour between 7 A.M. and 4 P.M. was the temperature highest? At what hour was it lowest? 7 A.M.
12 M.

Answers to ex. 7 are given below ex. 4–6 respectively.

Draw line graphs to show these temperatures: See G-81, 82.

4.

Hours	7	8	9	10	11	12	1	2	3	4	5	6
Degrees	50	51	54	57	58	63	64	64	63	59	57	52

(1) Highest: 1 P.M. and 2 P.M., lowest: 7 A.M.; (2) between 1 P.M. and 2 P.M.

5.

Hours	8	9	10	11	12	1	2	3	4	5	6	7
Degrees	75	78	78	79	83	85	87	88	87	86	83	81

(1) Highest: 3 P.M., lowest: 8 A.M.; (2) between 9 A.M. and 10 A.M.

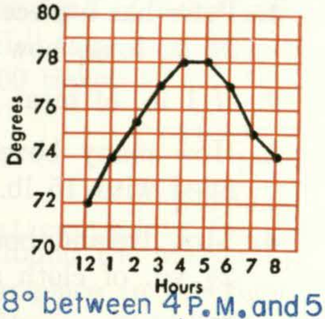
6.

Hours	9	10	11	12	1	2	3	4	5	6	7	8
Degrees	18	20	23	25	26	25	24	22	20	19	14	12

(1) Highest: 1 P.M., lowest: 8 P.M.; (2) none; (3) at 10 A.M. and 5 P.M.

7. On the graphs you drew for ex. 4–6, tell at what hours the temperature was highest and lowest.(1) Between what hours, if any, did the temperature remain the same?(2) In ex. 6, at what two hours of the day was the temperature 20°?(3)

Supply pupils with squared paper to use to draw their line graphs. Make comparisons between pupils' line graphs, used to record their scores, and ones on these pages. Also point out that bar graphs could be made of these data.



1. On this line graph what is the temperature at 12 noon? 72° at 1 P.M.? 74° at 3 P.M.? 77° at 4 P.M.? 78° at 5 P.M.? 78° at 6 P.M.? 77° at 7 P.M.? 75° at 8 P.M.? 74°

2. At 2 P.M. the temperature is halfway between 75° and 76°. What temperature is that? 75$\frac{1}{2}$°

3. What are the highest temperatures on the graph and at what hours did they occur? 78° between 4 P.M. and 5 P.M. What is the lowest temperature and at what hour did it occur? 72° at 12 M.

4. Where would 12:30 P.M. be on the horizontal scale? Halfway between 12 M. and 1 P.M. Estimate the temperature at 12:30 P.M. 73° Estimate the temperature at 3:30; 77$\frac{1}{2}$° at 4:30; 78° at 6:30; 76° at 7:30. 74$\frac{1}{2}$°

Draw line graphs to show the temperatures given in ex. 5 and 6: See G–82, 83.

Be sure pupils show data accurately in ex. 5–6.

5.

Hour	10	11	12	1	2	3	4	5	6	7	8
Degrees	50	53$\frac{1}{2}$	55	55	57	61	62$\frac{1}{2}$	62	57	55	49

From your graph for ex. 5 estimate the temperature at 12:30; 55° at 1:30; 56° at 6:30. 56°

6.

Hour	7	8	9	10	11	12	1	2	3	4	5
Degrees	20	22	25	28	32	38	37	36	34	31$\frac{1}{2}$	27

Study the graph for ex. 6 and answer these questions:

(a) At what two hours of the day was the temperature about 35°? 11:30 A.M. and 2:30 P.M.

(b) Estimate the temperature at 7:30; 21° at 10:30. 30°

(c) About when was the temperature 23$\frac{1}{2}$°? 8:30 A.M. 26$\frac{1}{2}$°? 9:30 A.M.

7. Read a thermometer each hour from 9 A.M. to 4 P.M. and make a graph showing your readings.

8. Try to find a good line graph in a newspaper or magazine and bring it to class. Explain it to the class. Post on bulletin board.

Be sure all pupils can locate data in ex. 1–4. For ex. 7, place thermometers in different parts of room. Have some pupils make graphs for one thermometer's readings, others for different thermometer's readings. Compare differences in temperatures.

Review the four fundamental operations with respect to common fractions.

Review of Fractions

1. Peter has a piece of lumber 8 ft. long. If he cuts off a piece $2\frac{1}{2}$ ft. long, how much will be left? $5\frac{1}{2}$ ft.

2. If 1 lb. of meat costs 56¢, how much will $1\frac{3}{4}$ lb. cost? 98¢

3. How many boxes, each containing $\frac{5}{8}$ lb. of candy, can be filled with 15 lb. of candy? 24

4. Mrs. Ireland bought $3\frac{1}{2}$ yd. of ribbon at \$.28 a yard and $2\frac{3}{4}$ yd. of cloth at \$.88 a yard. How much was the bill? \$3.40

5. Using the numbers 4, 5, 6, or any two of them, write an example of each of these: a proper fraction in its lowest terms; a proper fraction not in lowest terms; an improper fraction; a mixed number. Answers will vary.

Add. Check by going over the work:

6.	$3\frac{1}{2}$	$7\frac{7}{16}$	$3\frac{3}{10}$	$4\frac{5}{6}$	$6\frac{1}{2}$	$4\frac{5}{6}$	$1\frac{7}{10}$	$4\frac{3}{4}$
	$4\frac{3}{4}$	$1\frac{9}{16}$	$1\frac{1}{10}$	$\frac{5}{12}$	$5\frac{2}{3}$	$1\frac{1}{4}$	$3\frac{4}{5}$	$6\frac{3}{4}$
	$8\frac{1}{4}$	9	$4\frac{2}{5}$	$5\frac{1}{4}$	$12\frac{1}{6}$	$6\frac{1}{12}$	$5\frac{1}{2}$	$11\frac{1}{2}$
7.	$5\frac{3}{4}$	$2\frac{1}{5}$	$3\frac{5}{6}$	$4\frac{1}{4}$	$2\frac{1}{2}$	$3\frac{5}{6}$	$1\frac{1}{5}$	$2\frac{1}{2}$
	$1\frac{1}{2}$	$1\frac{7}{10}$	$1\frac{1}{3}$	$2\frac{1}{3}$	$4\frac{3}{8}$	$2\frac{1}{2}$	$2\frac{3}{5}$	$7\frac{3}{4}$
	$2\frac{3}{4}$	$3\frac{1}{2}$	$1\frac{1}{12}$	$1\frac{1}{4}$	$3\frac{1}{4}$	$1\frac{1}{3}$	$9\frac{1}{5}$	$1\frac{5}{8}$
	10	$7\frac{2}{5}$	$6\frac{1}{4}$	$7\frac{5}{6}$	$10\frac{1}{8}$	$7\frac{2}{3}$	13	$11\frac{7}{8}$

Subtract. Check by going over the work:

8.	1	$4\frac{13}{16}$	$6\frac{1}{2}$	$3\frac{5}{6}$	5	$6\frac{1}{2}$	$2\frac{3}{4}$	$5\frac{1}{4}$
	$\frac{2}{3}$	$3\frac{5}{16}$	$1\frac{3}{10}$	$3\frac{1}{2}$	$\frac{3}{4}$	$4\frac{2}{3}$	$2\frac{2}{3}$	$3\frac{5}{8}$
	$\frac{1}{3}$	$1\frac{1}{2}$	$5\frac{1}{5}$	$\frac{1}{3}$	$4\frac{1}{4}$	$1\frac{5}{6}$	$\frac{1}{12}$	$1\frac{5}{8}$
9.	4	$5\frac{3}{4}$	$2\frac{1}{10}$	$9\frac{1}{4}$	$6\frac{1}{8}$	$2\frac{1}{4}$	$7\frac{1}{6}$	$6\frac{1}{6}$
	$2\frac{1}{6}$	$3\frac{11}{12}$	$\frac{3}{5}$	$2\frac{7}{8}$	$3\frac{1}{2}$	$1\frac{15}{16}$	$3\frac{2}{3}$	$2\frac{5}{6}$
	$1\frac{5}{6}$	$1\frac{5}{6}$	$1\frac{1}{2}$	$6\frac{3}{8}$	$2\frac{5}{8}$	$\frac{5}{16}$	$3\frac{1}{2}$	$3\frac{1}{3}$

Find the answers:

10. $12 \div 1\frac{1}{2}$ 8 $\quad$ $4 \times \frac{3}{5}$ $2\frac{2}{5}$ $\quad$ $\frac{3}{8} \times 4$ $1\frac{1}{2}$ $\quad$ $\frac{9}{16} \div \frac{3}{4}$ $\frac{3}{4}$ $\quad$ $9 \times \frac{7}{12}$ $5\frac{1}{4}$

11. $2\frac{1}{2} \times 2\frac{1}{4}$ $5\frac{5}{8}$ $\quad$ $\frac{3}{4} \div 2$ $\frac{3}{8}$ $\quad$ $\frac{1}{2} \times \frac{5}{8}$ $\frac{5}{16}$ $\quad$ $1\frac{3}{4} \div \frac{1}{8}$ 14 $\quad$ $\frac{5}{6} \div 1\frac{1}{4}$ $\frac{2}{3}$

All process steps taught for common fractions are reviewed on this page; see G-83 for coverage. After checking papers and analyzing errors, return them to pupils so they may find and correct mistakes. Plan for reteaching as needed.

First review place value: 5 × 10 is 5 tens or 50, 5 × 100 is 5 hundreds or 500. Let pupils use moving arrow to show thought process, 5 × 10 = 50, and so on.
Discuss reverses, 10 × 5 = 50,
and 2- and 3-figure numbers, 100 × 583 = 58300.

Multiplying by 10, 100, 1000

1. Mr. Hill sells tickets at the circus. One kind of ticket sells for $1.25 each. How much does Mr. Hill take in if he sells 10 tickets?A if he sells 100 tickets?B 1000 tickets?C

A.	B.	C.
$1.25 10 $12.50	$1.25 100 $125.00	$1.25 1000 $1250.00

Through discussion, lead pupils to generalizations in following.

Look at A above. You could have found the answer by moving the decimal point in $1.25 one place to the right. In B, you could have got $125.00 for the answer by moving the decimal point in $1.25 two places to the right. In C, you could have got $1250.00 by moving the decimal point in $1.25 three places to the right.

Emphasize after understanding is assured.

To multiply a number by 10, 100, or 1000 move the decimal point as many places to the right as there are zeros in the multiplier.

Using the rule, multiply each number by 10;(1) by 100;(2) by 1000:(3)

(1),(2) $27.50;$275 $2.75;$27.50 $341.20;$3412 $4420;$44,200 2;20 .9;9 73,730
(3) **2.** $2.75 $2750 $.275 $275 $34.12 $34,120 $442 $442,000 .2 200 .09 90 7.3 7300
$93.50;$935 $1.93;$19.30 $127.90;$1279 $3040;$30,400 7;70 .3;3 17;170
3. $9.35 $9350 $.193 $193 $12.79 $12,790 $304 $304,000 .7 700 .03 30 1.7 1700
$59.10;$591 $2.69;$26.90 $299.80;$2998 $7200;$72,000 4;40 .5;5 49;490
4. $5.91 $5910 $.269 $269 $29.98 $29,980 $720 $720,000 .4 400 .05 50 4.9 4900

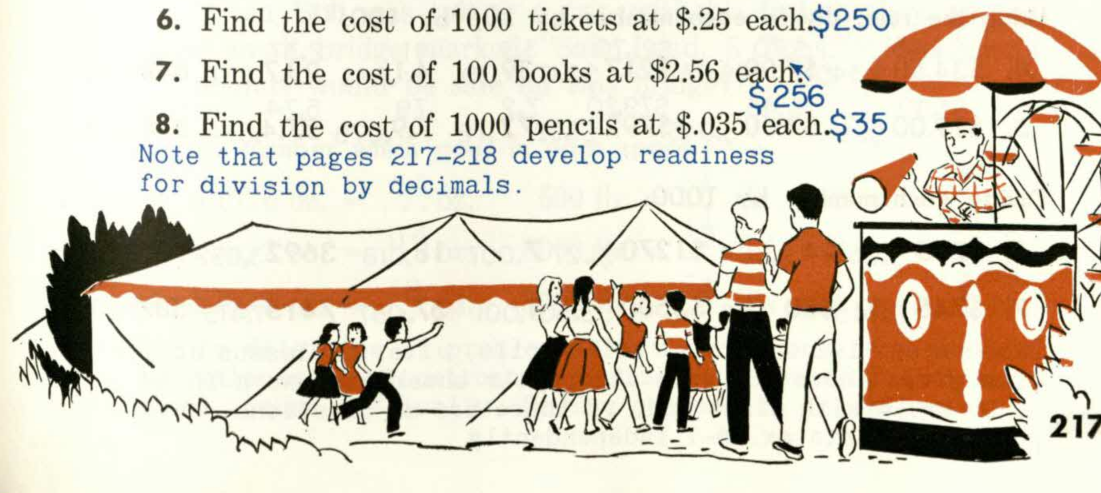
5. Find the cost of 10 gal. of gasoline at $.248 a gallon. $2.48

6. Find the cost of 1000 tickets at $.25 each. $250

7. Find the cost of 100 books at $2.56 each. $256

8. Find the cost of 1000 pencils at $.035 each. $35

Note that pages 217-218 develop readiness for division by decimals.



Dividing by 10, 100, 1000

Do some division by 10 first: $10\overline{)\,80}^{\,8}$ or 80 ÷ 10 = 8, $10\overline{)\,47.0}^{\,4.7}$ or 47 ÷ 10 = 4.7, and so on. Lead pupils to see that in division by 10 you move decimal point to left, since division is inverse of multiplication.

1. **Problem** Ann's mother bought 10 yd. of linen for $8.75. What was the cost per yard? 87½¢

$$\begin{array}{r} \$.875 \\ 10\overline{)\,\$8.750} \\ 8\,0 \\ \hline 75 \\ 70 \\ \hline 50 \\ 50 \\ \hline \end{array}$$

Explanation When you divide as shown here, you get $.875. You can also divide $8.75 by 10 by moving the decimal point one place to the left, which gives $.875. The linen cost $.875 or 87½¢ a yard.

2. **Problem** Henry's father does electric wiring. He bought 100 ft. of wire for $6.50. Find the cost of 1 ft. of wire. 6½¢

Explanation You can divide $6.50 by 100 by moving the decimal point two places to the left. Since there is only one figure to the left of the decimal point, you must place a zero in front of 6 so that you can do this. The wire cost $.065 or 6½¢ a foot.

$6.50 ÷ 100 = $.065

3. Study each example and tell how the answer was found:

$14.90 ÷ 10 = $1.49　　$63.00 ÷ 100 = $.63

$19.00 ÷ 1000 = $.019

Emphasize after understanding is assured.

To divide by 10, 100, or 1000, move the decimal point as many places to the left as there are zeros in the divisor.

Using the rule, divide each number by 10;⁽¹⁾ by 100:⁽²⁾

(1)
(2)

4. $34.50 $3.45 $.345　$7.00 $.70 $.07　$217 $21.70 $2.17　39 3.9 .39　4.1 .41 .041　23.7 2.37 .237　648 64.8 6.48

5. $19.00 $1.90 $.19　$4.50 $.45 $.045　$792 $79.20 $7.92　72 7.2 .72　7.9 .79 .079　57.4 5.74 .574　319 31.9 3.19

Divide each number by 1000:

6. $250 $.25　$4 $.004　$1270 $1.27　7 .007　18 .018　3692 3.692　906 .906

7. $745 $.745　$30 $.03　$3500 $3.50　1 .001　57 .057　7415 7.415　537 .537

Discuss ex. 1–2 carefully with pupils, after prelesson activities given above. Be sure all pupils understand work in ex. 3. Do ex. 4 with class and, if there are no questions, have pupils complete ex. 5–7 independently.

Review measures of weight in problems involving decimals and common fractions.

Measures of Weight

1. Review this table of measures of weight:

16 ounces (oz.) = 1 pound (lb.)
2000 pounds = 1 ton (T.)

2. What part of a pound is 12 oz.? $\frac{3}{4}$ 4 oz.? $\frac{1}{4}$ 14 oz.? $\frac{7}{8}$

3. What part of a ton is 500 lb.? $\frac{1}{4}$ 200 lb.? $\frac{1}{10}$ 1200 lb.? $\frac{3}{5}$

4. Name 2 things that are sold by the ounce; 4 things that are sold by the pound; 2 things that are sold by the ton.

5. Mr. Lamb has a 2-ton truck, which means that the truck will carry a load of 2 tons. How many boxes each weighing 125 lb. can the truck carry? 32

6. Mr. Green shipped some furniture by freight. It weighed 450 lb., and the freight rate was \$1.86 per hundred pounds. How much did it cost to ship the furniture? \$8.37

▶ You find that 450 is 4.5 hundreds by moving the decimal point two places to the left. Then find 4.5 × \$1.86.

7. If the 100-pound rate for sending a box of books by express is \$4.82, find the cost of sending a box weighing 150 lb. \$7.23

8. Mr. Hall sold some hogs in the livestock market. Their total weight was 4800 lb. The hogs sold at \$14.50 per hundred pounds. How much did Mr. Hall get for the hogs? \$696.00

9. When Bob was taking a trip with his father, they crossed a small bridge marked "Safe Load, 5 Tons." How many pounds would be safe on this bridge? 10,000

Tell the number which goes in each space:

10. 3 lb. 6 oz. = $\overset{54}{\ldots}$ oz. 500 lb. = $\overset{\frac{1}{4}}{\ldots}$ T. 8 oz. = $\overset{\frac{1}{2}}{\ldots}$ lb.

11. 7 lb. 2 oz. = $\overset{114}{\ldots}$ oz. 3000 lb. = $\overset{1\frac{1}{2}}{\ldots}$ T. 6 oz. = $\overset{\frac{3}{8}}{\ldots}$ lb.

12. 1 lb. 2 oz. = $\overset{18}{\ldots}$ oz. 8000 lb. = $\overset{4}{\ldots}$ T. 14 oz. = $\overset{\frac{7}{8}}{\ldots}$ lb.

Try to determine if problem situations, processes, measure equivalents, applications of decimal and common fractions, and so on, cause difficulty. Review or reteach accordingly.

Present and explain fundamental principle used in division of decimals, and show how to divide decimal by decimal.

Dividing by a Decimal

1. Study these three examples carefully:

A. $\begin{array}{r} 8 \\ 3\overline{)24} \end{array}$ B. $\begin{array}{r} 8 \\ 30\overline{)240} \end{array}$ C. $\begin{array}{r} 8 \\ 300\overline{)2400} \end{array}$

If you multiply both the divisor and the dividend of ex. A by 10, you get ex. B; by 100, you get ex. C. All three quotients are the same.

Emphasize after demonstration.

Multiplying both the divisor and the dividend by 10, by 100, or by 1000 does not change the quotient.

This is the same as multiplying both terms of a fraction by 10, by 100, or by 1000. You can think of the above division examples as the fractions $\frac{24}{3}$, $\frac{240}{30}$, and $\frac{2400}{300}$. If you multiply both the numerator and denominator of $\frac{24}{3}$ by 10 you get $\frac{240}{30}$. So $\frac{24}{3} = \frac{240}{30}$. Why? Explain why $\frac{24}{3} = \frac{2400}{300}$. You see that all three fractions are equal to 8.

2. **Problem** The girls in the Sewing Club made \$12.15 with their cookie sale. How many yards of cloth at \$.45 a yard can they buy with this money? 27

$$\begin{array}{r} .45\overline{)12.15} \\ 27 \\ 45\overline{)1215} \\ 90 \\ \hline 315 \\ 315 \\ \hline \end{array}$$

Explanation You need to divide 12.15 by .45; but the divisor is a decimal. You know how to divide by a whole number. So you multiply .45 by 100, which changes the divisor to the whole number 45. Since you have multiplied .45 by 100 you must also multiply 12.15 by 100.

Emphasize.

You now divide 1215 by 45 and get a quotient of 27. The quotient for 12.15 divided by .45 is also 27. The girls can buy 27 yards of cloth. Check by multiplying 27 by .45.

3. At \$.35 a yard, how many yards of ribbon can you buy for \$4.20? 12 How many yards can you buy for \$8.75? 25

More Practice. See ㊻ on page 324. Use to reinforce understanding.

In discussing ex. 1 relate to common fractions and principle of numbers: if numerator and denominator of fraction are multiplied by same number, value of fraction is unchanged ($\frac{24}{3} = \frac{240}{30} = \frac{2400}{300}$). Do few more examples.

Continue practice in division by decimals (pages 221-222). Emphasize that "both" divisor and dividend must be multiplied by same number.

Dividing by a Decimal

1. The boys in the Fishing Club made $25.90 by collecting and selling old newspapers and magazines. They are going to buy fishing rods with this money. How many rods at $1.85 each can the boys buy? 14

▶ You want to make the divisor a whole number. So you multiply Stress. ——>both 1.85 and 25.90 by 100 by moving each decimal point two places to the right. Then you divide.

2. Bob wants to buy a radio that costs $19.50. If he saves $1.50 a week, how many weeks will it take him to save $19.50? 13 to save $39.00? 26

3. **Problem** How many feet of rope that costs $.04 a foot can you buy for $7.00? 175

Explanation You need to divide 7.00 by .04. First change .04 to a whole number by moving the decimal point two places to the right; this gives 04., which is the same as 4. Also move the decimal point in 7.00 two places to the right, which gives 700. Then divide. Why is 175 also the quotient for 7.00 ÷ .04?

You can buy 175 ft. of rope. Check the work.

$$.04\overline{)7.00}$$

$$\begin{array}{r} 175 \\ 4\overline{)700} \end{array}$$

Check

$$\begin{array}{r} 175 \\ .04 \\ \hline 7.00 \end{array}$$

Pupils should understand that they multiplied by 100 in ex. 3.

Divide and check. First change each divisor to a whole number:

4. $8.75 ÷ $.25 35 $12.15 ÷ $1.35 9 5.52 ÷ .08 69 56.7 ÷ .9 63

5. $5.13 ÷ $.19 27 $74.52 ÷ $2.07 36 6.51 ÷ .07 93 34.8 ÷ .4 87

6. $26.04 ÷ $.42 62 $44.32 ÷ $5.54 8 243.2 ÷ 3.2 76 33.6 ÷ .7 48

7. $18.20 ÷ $.65 28 $74.75 ÷ $3.25 23 158.1 ÷ 1.7 93 76.8 ÷ .8 96

8. $31.54 ÷ $.38 83 $19.25 ÷ $2.75 7 167.5 ÷ 2.5 67 26.7 ÷ .3 89

Have pupils explain "how" they change divisors in ex. 4-8 and "why" they were able to do so.

More Practice. See ㊼ on page 325.

Some pupils may need review of principle given on page 220. Demonstrate, using common and decimal fractions. Have pupils continue to rewrite examples (as in ex. 3) until they discover own short cuts (writing new version immediately, moving arrow, caret device).

Dividing by a Decimal

1. Problem Mr. Ash made a trip of 147 mi. in 4.5 hr. Find, to the nearest tenth of a mile, his average speed in miles per hour. 32.7

$$4.5\overline{)147}$$

Explanation You must divide 147 by 4.5. To make the divisor 4.5 a whole number, move the decimal point one place to the right, which gives 45. Also move the decimal point in 147 one place to the right; to do this, first annex a zero to 147, which gives 1470.

$$\begin{array}{r} 32.66 \\ 45\overline{)1470.00} \\ 135 \\ \hline 120 \\ 90 \\ \hline 30\;0 \\ 27\;0 \\ \hline 3\;00 \\ 2\;70 \\ \hline 30 \end{array}$$

Rounding off the quotient 32.66, you get 32.7. Mr. Ash's average speed on this trip was 32.7 mi. per hour, correct to the nearest tenth of a mile. Ask pupils to explain "why" decimal point is moved one place to right (multiplied by 10).

2. A train traveled 170 mi. in 3.5 hr. Find, to the nearest tenth of a mile, its average speed in miles per hour. 48.6

3. Jim walked 1.75 mi. in .5 hr. What was his average speed in miles per hour? 3.5

4. An airplane flew a distance of 13.75 mi. in 2.5 min. Find the speed of the airplane in miles per minute. 5.5 Also find its speed in miles per hour. 330

5. Mr. White has found that it costs him $.07 a mile to drive his car. At that rate, how far can he drive his car at a cost of $25? Give the result correct to the nearest mile. 357

Divide. If you continue to have a remainder, carry the quotient to 2 decimal places and round off to the nearest tenth:

6. $\overset{5.3}{.6\overline{)3.2}}$ $\overset{5.7}{.3\overline{)1.7}}$ $\overset{7}{.9\overline{)6.3}}$ $\overset{.715}{.2\overline{).143}}$ $\overset{1.6}{1.6\overline{)2.59}}$ $\overset{25.1}{.051\overline{)1.28}}$

7. $\overset{2.8}{.9\overline{)2.5}}$ $\overset{16}{.4\overline{)6.4}}$ $\overset{.4}{.7\overline{).29}}$ $\overset{.3}{.9\overline{).294}}$ $\overset{1.8}{.19\overline{).342}}$ $\overset{21.8}{.211\overline{)4.61}}$

8. $\overset{8.4}{.7\overline{)5.9}}$ $\overset{9.5}{.8\overline{)7.6}}$ $\overset{.9}{.6\overline{).55}}$ $\overset{86.8}{.6\overline{)52.1}}$ $\overset{1687.5}{.08\overline{)135}}$ $\overset{42}{.004\overline{).168}}$

9. $\overset{1.5}{.6\overline{).88}}$ $\overset{1.2}{.7\overline{).84}}$ $\overset{3.75}{.4\overline{)1.5}}$ $\overset{4.2}{.9\overline{)3.82}}$ $\overset{1510}{.06\overline{)90.6}}$ $\overset{858}{.005\overline{)4.29}}$

More Practice. See ㊽ on page 325.

In discussing ex. 1, it may be necessary to review further rounding off to nearest tenth. Do ex. 2–5 with pupils. Be sure they see by what power of 10 both divisor and dividend must be multiplied to make divisor a whole number.

Present set of improvement tests in subtraction.

Subtraction Test 4a.

Time: 4 min.

1.	$462.38 69.57 $392.81	$280.70 159.95 $120.75	$346.83 98.27 $248.56	$636.20 148.42 $487.78	
2.	$600.00 247.36 $352.64	$127.17 37.54 $ 89.63	$602.34 467.96 $134.38	$249.17 92.89 $156.28	
3.	$539.78 69.83 $469.95	$495.00 457.57 $ 37.43	$936.64 477.98 $458.66	$134.42 36.85 $97.57	⑫

Subtraction Test 4b.

Time: 4 min.

4.	$651.12 454.98 $196.14	$141.46 68.79 $72.67	$846.97 63.98 $782.99	$787.23 364.64 $422.59	
5.	$162.97 39.89 $123.08	$470.00 128.13 $341.87	$168.22 76.23 $ 91.99	$676.16 56.18 $619.98	
6.	$500.22 232.86 $267.36	$162.34 97.53 $64.81	$400.00 158.92 $241.08	$274.56 269.73 $ 4.83	⑫

Subtraction Test 4c.

Time: 4 min.

7.	$139.24 86.97 $ 52.27	$221.83 156.13 $ 65.70	$460.54 286.69 $173.85	$511.22 79.35 $431.87	
8.	$583.34 513.85 $ 69.49	$359.47 84.94 $274.53	$142.00 52.34 $ 89.66	$591.82 358.74 $233.08	
9.	$191.23 95.44 $ 95.79	$179.34 97.78 $ 81.56	$700.00 104.76 $595.24	$877.46 387.69 $489.77	⑫

To the Pupil. This is the fourth set of Improvement Tests on Subtraction. Try to get a score of 10 on each test.

Have pupils compare graph of scores for these tests with previous ones (pages 67, 127, 183). Group pupils who made mistakes to help them analyze causes (zero difficulties, borrowing, carelessness, and so on). Assign remedial work.

Review subtraction and multiplication of mixed decimals.

Subtraction and Multiplication

1. Martha is saving money to buy a record player that has a price of \$33.50. She now has \$19.75 in her savings account. How much more must she save in order to be able to buy this record player? \$13.75

2. Mr. Baker plans to drive his car 50,000 miles before trading it in for a new one. The speedometer of Mr. Baker's car now reads 34,782 mi. How many more miles will Mr. Baker drive this car before trading it in? 15,218

3. Jean's mother is going to make slipcovers for their living room furniture. She bought 26 yards of material at \$3.95 a yard. What was the total cost of the material? \$102.70

4. Find the area of a rectangle 27.4 ft. long and 19.7 ft. wide. 539.78 sq. ft.

Subtract. Check your work by adding:

5.	2372 875 1497	5.750 3.875 1.875	74.32 58.43 15.89	8373.3 3675.9 4697.4	\$7898.25 2106.48 \$5791.77
6.	5186 1248 3938	6.250 4.625 1.625	76.95 53.89 23.06	4183.8 2654.8 1529.0	\$6000.00 5580.17 \$ 419.83
7.	4000 1164 2836	7.000 2.375 4.625	44.49 6.41 38.08	9421.8 1569.2 7852.6	\$1279.53 414.93 \$ 864.60

Multiply and check your work:

8.	2689 352 946,528	275 .07 19.25	1.25 9 11.25	103 .006 .618	.12 .4 .048	7.36 23.7 174.432
9.	4365 768 3,352,320	200 .12 24.00	125 .07 8.75	738 .002 1.476	1.6 .03 .048	.243 146 35.478
10.	1738 506 879,428	628 .006 3.768	83.4 .18 15.012	473 .001 .473	8.7 .08 .696	58.4 2.57 150.088

Note that major learning being reviewed is placement of decimal point. Have pupils explain work to be sure they have understanding of this and not just mechanical mastery of it.

Present certain zero difficulties in division of decimals (pages 225-226).

Zeros in the Quotient

1. **Problem** Peggy bought a card of white braid for \$.28. The card contained 8 yd. of braid. Find the cost of the braid per yard. $3\frac{1}{2}$¢

Explanation Divide .28 by 8 by annexing a zero at the right of .28 to avoid a remainder. Place the 3 of the quotient above the 8 of 28 since 28 was divided by 8 to get 3. When you write the decimal point in the quotient directly above the decimal point in .280, you leave an empty space in the quotient between the decimal point and 3. This should be filled with a zero, which gives .035 for the quotient. The braid costs \$.035, or $3\frac{1}{2}$¢, a yard.

$$\begin{array}{r} .035 \\ 8\overline{).280} \end{array}$$

Check

$$\begin{array}{r} .035 \\ 8 \\ \hline .280 \end{array}$$

2. **Problem** Last month the bill for the milk used by the pupils at the Washington School was \$324. Each bottle of milk cost \$.06. How many bottles of milk were used last month? 5400

Explanation Change the divisor to a whole number by multiplying by 100, which gives 6. When 324 is multiplied by 100 it becomes 32400. The quotient is 5400. To check, multiply 5400 by .06.

The school used 5400 bottles of milk last month.

$$.06\overline{)324}$$

$$\begin{array}{r} 5400 \\ 6\overline{)32400} \end{array}$$

Have pupils explain zeros in quotients and placement of quotient figures in ex. 3-9.

Divide and check:

3.	.06 7).42	.085 4).34	.027 5).135	5800 .06)348	340 .8)272	360 .3)108
4.	.09 3).27	.065 8).52	.039 6).234	6400 .04)256	270 .9)243	620 .2)124
5.	.08 6).48	.095 2).19	.019 9).171	2200 .07)154	810 .4)324	180 .7)126
6.	.07 9).63	.075 6).45	.009 8).072	590 .03)17.7	730 .5)365	210 .9)189
7.	.08 4).32	.045 8).36	.005 7).035	260 .09)23.4	900 .6)540	360 .4)144
8.	.06 8).48	.095 4).38	.008 3).024	620 .08)49.6	600 .7)420	420 .6)252
9.	.09 5).45	.08 9).72	.009 4).036	7700 .05)385	890 .3)267	760 .8)608

In ex. 1, be sure pupils understand "why" zero is placed in quotient (to show that tenths were divided and there are none) and "why" 3 is placed over 8 (since 28 "hundredths" were divided). Emphasize place value in ex. 3-9.

More Division of Decimals

1. Study these examples carefully. In each example, explain how the work was done. Then check each example:

A. $.028\overline{)9.52}$

$$\begin{array}{r} 340 \\ 28\overline{)9520} \\ \underline{84} \\ 112 \\ \underline{112} \\ 0 \end{array}$$

B. $1.8\overline{).126}$

$$\begin{array}{r} .07 \\ 18\overline{)1.26} \\ \underline{1.26} \end{array}$$

C. $.025\overline{)67.5}$

$$\begin{array}{r} 2700 \\ 25\overline{)67500} \\ \underline{50} \\ 175 \\ \underline{175} \\ 00 \end{array}$$

Divide and check: Do some orally to clear up any difficulties.

2. $\overset{.04}{3\overline{).12}}$ $\overset{.09}{9\overline{).81}}$ $\overset{.04}{.6\overline{).024}}$ $\overset{3100}{.07\overline{)217}}$ $\overset{.06}{1.2\overline{).072}}$ $\overset{190}{.025\overline{)4.75}}$

3. $\overset{.03}{7\overline{).21}}$ $\overset{.08}{6\overline{).48}}$ $\overset{.02}{.8\overline{).016}}$ $\overset{7300}{.04\overline{)292}}$ $\overset{.04}{3.7\overline{).148}}$ $\overset{1200}{.032\overline{)38.4}}$

4. $\overset{.06}{4\overline{).24}}$ $\overset{.08}{7\overline{).56}}$ $\overset{50}{.9\overline{)45}}$ $\overset{1800}{.06\overline{)108}}$ $\overset{.06}{2.1\overline{).126}}$ $\overset{430}{.019\overline{)8.17}}$

5. $\overset{.09}{8\overline{).72}}$ $\overset{.09}{3\overline{).27}}$ $\overset{90}{.7\overline{)63}}$ $\overset{8600}{.03\overline{)258}}$ $\overset{.07}{4.8\overline{).336}}$ $\overset{1700}{.041\overline{)69.7}}$

Divide. Find the quotients to the nearest tenth: Stress.

6. $\overset{.1}{7\overline{).85}}$ $\overset{.3}{3\overline{).89}}$ $\overset{.8}{.6\overline{).47}}$ $\overset{96.7}{.03\overline{)2.9}}$ $\overset{1.2}{.29\overline{).35}}$ $\overset{17.1}{.013\overline{).222}}$

7. $\overset{.2}{4\overline{).73}}$ $\overset{.1}{7\overline{).94}}$ $\overset{.8}{.8\overline{).62}}$ $\overset{38.9}{.09\overline{)3.5}}$ $\overset{.5}{1.8\overline{).98}}$ $\overset{.3}{1.62\overline{).453}}$

8. $\overset{.2}{6\overline{).97}}$ $\overset{.1}{8\overline{).99}}$ $\overset{1.6}{.3\overline{).49}}$ $\overset{342.9}{.07\overline{)24}}$ $\overset{12.7}{6.3\overline{)80}}$ $\overset{.8}{11.5\overline{)8.74}}$

Divide. Find the quotients to the nearest hundredth: Stress.

9. $\overset{3.15}{2.7\overline{)8.5}}$ $\overset{7.10}{.34\overline{)2.415}}$ $\overset{7.38}{1.9\overline{)14.026}}$ $\overset{1.24}{1.2\overline{)1.484}}$ $\overset{7.74}{32\overline{)247.62}}$

10. $\overset{5.79}{.38\overline{)2.2}}$ $\overset{.41}{4.5\overline{)1.832}}$ $\overset{.63}{52\overline{)32.765}}$ $\overset{.85}{25\overline{)21.36}}$ $\overset{40.11}{.29\overline{)11.633}}$

11. $\overset{2.83}{2.3\overline{)6.5}}$ $\overset{.85}{2.6\overline{)2.222}}$ $\overset{2.78}{3.9\overline{)10.837}}$ $\overset{3.03}{.78\overline{)2.365}}$ $\overset{4.45}{4.1\overline{)18.263}}$

12. $\overset{1.79}{1.9\overline{)3.4}}$ $\overset{.77}{3.2\overline{)2.451}}$ $\overset{6.60}{1.7\overline{)11.216}}$ $\overset{7.08}{.43\overline{)3.046}}$ $\overset{6.22}{3.6\overline{)22.403}}$

Discuss ex. 1 carefully with pupils, letting different ones explain each step. Be sure all know by what power of 10 both divisor and dividend are multiplied, and "why" this is, and can be, done.

Present problems involving division of decimals.

Problems and Practice

1. The North School held a picnic at Shadow Lake last week. The total cost of the picnic was \$52.85. If 292 pupils and teachers shared the cost equally, how much did each one pay? Find the answer to the nearest cent. \$.18

2. Henry bought 6 oranges for \$.27. How much did 1 orange cost? \$.04½ How much would 8 oranges cost at that price? \$.36

3. Mary paid \$1 for a piece of material on the bargain table at a store. The material was 1.5 yd. long. Find, to the nearest cent, the cost of the material per yard. \$.67

4. One kind of wire costs \$.067 per foot. How much of this wire could you buy for \$7.50? Find the answer correct to the nearest whole foot. About 112 ft.

5. Peter bought a box of 24 colored pencils for \$2.19. Find, correct to the nearest cent, the cost per pencil. \$.09

6. Mrs. Hall bought a can of shelled peanuts for \$.34. The can was marked 7.25 oz. Find, correct to the nearest cent, the cost of the peanuts per ounce. \$.05

Divide. If you continue to have a remainder, give the quotient correct to the nearest tenth:

7. $\begin{array}{r}3.7\\4.5\overline{)16.65}\end{array}$ $\begin{array}{r}164.4\\.037\overline{)6.083}\end{array}$ $\begin{array}{r}2.7\\1.86\overline{)5.021}\end{array}$ $\begin{array}{r}147\\6.54\overline{)961.38}\end{array}$

8. $\begin{array}{r}20.8\\.62\overline{)12.88}\end{array}$ $\begin{array}{r}1290\\.051\overline{)65.79}\end{array}$ $\begin{array}{r}37\\2.23\overline{)82.51}\end{array}$ $\begin{array}{r}8.3\\4.27\overline{)35.417}\end{array}$

More Practice. See (49) on page 325. Use to reinforce skill.

Have pupils do ex. 1-8 independently. Observe them as they work to see how they "attack" problems. Group those who had errors and have them talk out their solutions to try to determine causes of errors.

Develop ability to estimate correct answers in solving problems involving decimal fractions (pages 228–229).

Estimating Answers

At the end of each problem there are three numbers. Select the number you think is nearest to the right answer. Then work the problem and compare your answer with the number selected:

1. Bob had \$6.07 left after paying \$.95 for seeds. How much did he have before buying the seeds? \$6 \$7 \$8 \$7.02
2. John has \$7.95. If he buys 4 books at 49¢ each, how much money will he have left? \$4.50 \$5.00 \$6.00 \$5.99
3. Mr. Page spent \$4.99 when he stopped for gasoline and oil for his car. The gasoline cost \$3.89. How much did the oil cost? \$1.00 \$1.50 \$2.00 \$1.10
4. Four girls shared the cost of buying 10 packages of colored paper at 19¢ a package. What was each girl's share of the cost? 40¢ 50¢ 60¢ 47¢ for two girls and 48¢ for two girls
5. A round-trip ticket to Boston costs \$3.03. Find the cost of making that round trip once a week for 50 weeks. \$15.00 \$150.00 \$16.00 \$151.50
6. Mr. Clark drove his car 707 mi. and used 35 gal. of gasoline. What was the average number of miles he drove per gallon of gasoline? 18 mi. 20 mi. 22 mi. 20.2
7. Last month Jim sold a total of 2522 newspapers in 26 days. What was the average number of papers he sold per day? 85 papers 90 papers 100 papers 97
8. How much change do you get from \$10.00 if you buy 3 yd. of cloth at \$.48 a yard and a dress pattern for \$.51? \$8.00 \$7.50 \$7.00 \$8.05
9. Mr. Hall bought 15 gal. of gasoline at \$.296 a gallon. How much did the gasoline cost? \$3.50 \$4.00 \$4.50 \$4.44
10. At the beginning of the week Judy had \$2.01 on hand. Then she received her weekly allowance of \$.75 and earned \$.20 doing errands. During the week she spent \$.45 for the movies and \$.54 for a book. What was her balance at the end of the week? \$1.50 \$2.00 \$2.50 \$1.97

Review quickly the meaning of estimation: computing answer mentally, using numbers that mean about the same as those in the problem. Point out that when mixed decimals are involved, we round off to nearest whole number.

Evaluate extent of pupils' mastery of estimation skill.

Placing the Decimal Point

After each exercise three answers are given but only one answer is correct. Without working the exercise, tell which answer is correct:

1. Does 25.28 ÷ 7.9 equal .032, or .32, or 3.2? 3.2
2. Does 1.026 ÷ 1.9 equal .54, or 5.4, or 54? .54
3. Does 81.4 ÷ 37 equal .22, or 2.2, or 22? 2.2
4. Does 353.8 ÷ 6.1 equal 58, or 580, or 5800? 58
5. Does 15.25 ÷ 2.5 equal .61, or 6.1, or 61? 6.1
6. Does 427.2 ÷ .48 equal 8.9, or 89.0, or 890? 890
7. Does 3.255 ÷ 3.5 equal .093, or .93, or 9.3? .93
8. Does 226.2 ÷ 29 equal 7.8, or 78, or 780? 7.8

In these exercises the quotients are given, but the decimal points have been left out. In some quotients the 0's are also left out. In each quotient put the decimal point in the right place, supplying 0's if necessary:

9. $\begin{array}{r} 390. \\ .7\overline{)273} \end{array}$ $\begin{array}{r} .036 \\ 37\overline{)1.332} \end{array}$ $\begin{array}{r} 6\,800. \\ .031\overline{)210.8} \end{array}$ $\begin{array}{r} 2\,2.9 \\ 36.4\overline{)833.56} \end{array}$

10. $\begin{array}{r} .083 \\ 4\overline{).332} \end{array}$ $\begin{array}{r} 7.6 \\ 2.1\overline{)15.96} \end{array}$ $\begin{array}{r} 270. \\ 14.3\overline{)3861} \end{array}$ $\begin{array}{r} 4\,030. \\ .092\overline{)370.76} \end{array}$

11. $\begin{array}{r} 5.7 \\ .6\overline{)3.42} \end{array}$ $\begin{array}{r} .084 \\ 22\overline{)1.848} \end{array}$ $\begin{array}{r} .0\,41 \\ 215\overline{)8.815} \end{array}$ $\begin{array}{r} .0\,63 \\ 435\overline{)27.405} \end{array}$

12. $\begin{array}{r} 4\,6. \\ .8\overline{)36.8} \end{array}$ $\begin{array}{r} 9.6 \\ 7.3\overline{)70.08} \end{array}$ $\begin{array}{r} 10,400. \\ .067\overline{)696.8} \end{array}$ $\begin{array}{r} 7\,80. \\ 2.73\overline{)2129.4} \end{array}$

13. $\begin{array}{r} 980. \\ .3\overline{)294} \end{array}$ $\begin{array}{r} 9\,40. \\ .19\overline{)178.6} \end{array}$ $\begin{array}{r} .9 \\ 2.84\overline{)2.556} \end{array}$ $\begin{array}{r} 31\,5. \\ 25.1\overline{)7906.5} \end{array}$

14. $\begin{array}{r} .047 \\ 9\overline{).423} \end{array}$ $\begin{array}{r} 1.13 \\ 8.7\overline{)9.831} \end{array}$ $\begin{array}{r} 780. \\ .019\overline{)14.82} \end{array}$ $\begin{array}{r} .0\,96 \\ 182\overline{)17.472} \end{array}$

15. $\begin{array}{r} 6\,9. \\ .4\overline{)27.6} \end{array}$ $\begin{array}{r} 2\,03. \\ .35\overline{)71.05} \end{array}$ $\begin{array}{r} 9\,240. \\ .009\overline{)83.16} \end{array}$ $\begin{array}{r} 52,100. \\ .066\overline{)3438.6} \end{array}$

Do this work orally. In ex. 1–8 have pupils explain "how" they chose answers (ex. 1: 25 ÷ 8 is 3, so answer must be about 3; ex. 2: 1 ÷ 2 is ½, and so on). In ex. 9–15 they should be able to explain mental multiplication by 10, 100, or 1000.

See G-87 for correlation of examples with aims.

Chapter Review

1. Martha bought a quart of ice cream for $.65. She served 6 persons with it. What was the cost of one serving of ice cream? Find the answer to the nearest cent. $.11

2. Peter's father bought a 100-foot roll of wire netting for $7.50. What was the cost of the netting per foot? $.075

3. Fred's brother shipped home a box of books that weighed 220 lb. The freight rate per hundred pounds was $1.39. What did it cost to ship the books home? $ 3.06

4. Round off each decimal to the nearest tenth: 6.41, 6.4 9.27, 9.3 5.83, 5.8 7.88, 7.9 4.08, 4.1 6.98, 7.0 14.02, 14.0 17.77, 17.8 .08. .1

5. Round off each decimal to the nearest hundredth: 2.727, 2.73 8.312, 8.31 5.381, 5.38 4.888, 4.89 3.096, 3.10 .179, .18 9.227. 9.23

6. Change to decimals:

$\frac{1}{4}$ .25 $\frac{4}{5}$ .8 $\frac{1}{2}$ .5 $\frac{3}{8}$ .375 $\frac{3}{4}$ .75 $\frac{7}{8}$ .875 $\frac{9}{20}$ .45 $\frac{7}{10}$ .7 $\frac{1}{20}$ .05 $\frac{6}{25}$ .24 $\frac{13}{20}$ .65

7. Change to decimals correct to the nearest hundredth:

$\frac{2}{3}$ .67 $\frac{8}{9}$ .89 $\frac{5}{7}$ .71 $\frac{1}{6}$ .17 $\frac{1}{3}$ .33 $\frac{5}{6}$ .83 $\frac{5}{12}$ .42 $\frac{3}{11}$ .27 $\frac{4}{15}$ .27 $\frac{3}{22}$ .14 $\frac{9}{19}$ .47

Divide until there is no remainder. Annex zeros to the dividend if necessary:

8. $\overset{.073}{3\overline{).219}}$ $\overset{2.635}{.2\overline{).5270}}$ $\overset{.008}{8\overline{).064}}$ $\overset{230}{2.8\overline{)644}}$ $\overset{.013}{19\overline{).247}}$ $\overset{2.15}{2.4\overline{)5.160}}$

9. $\overset{7.3}{.8\overline{)5.84}}$ $\overset{3.26}{5\overline{)16.30}}$ $\overset{156.5}{.4\overline{)62.60}}$ $\overset{.7}{.07\overline{).049}}$ $\overset{2450}{.32\overline{)78400}}$ $\overset{7.75}{.64\overline{)4.9600}}$

Divide. In ex. 10, find quotients correct to nearest tenth. In ex. 11, find quotients correct to nearest hundredth:

10. $\overset{.9}{7\overline{)6.1}}$ $\overset{5.7}{9\overline{)510}}$ $\overset{3.0}{.3\overline{).89}}$ $\overset{.2}{6\overline{).94}}$ $\overset{.1}{5.2\overline{).375}}$ $\overset{.9}{21\overline{)18.3}}$

11. $\overset{.46}{.7\overline{).320}}$ $\overset{2.83}{6\overline{)1700}}$ $\overset{.84}{8\overline{)6.70}}$ $\overset{.59}{7\overline{)4.10}}$ $\overset{5.24}{.33\overline{)1.7300}}$ $\overset{1.41}{37\overline{)52.20}}$

Use review as preparation for diagnostic test and as test of readiness for new work. Urge pupils who had errors to talk out their computations to see if processes, concepts, and so on, cause difficulty. Let others work on decimal magic squares.

A Problem Test

1. In our school there are 648 pupils. Of this total number, 360 are boys. The boys are what part of all the pupils? $\frac{360}{648} = \frac{5}{9}$

2. At 36 for a dime, find the cost of 144 thumbtacks. 40¢

3. The speedometer on Mr. Hall's car read 20,276 mi. at the beginning of the year and 29,008 mi. at the end of the year. How many miles did Mr. Hall drive during the year? 8732

4. Find the cost of $1\frac{3}{4}$ lb. of meat at \$.45 a pound. \$.78$\frac{3}{4}$, or \$.79

5. Last fall Mr. Clark had 85 bu. of apples to sell. He sold 32 bu. at \$1.75 a bushel and the rest at \$2.25 a bushel. How much in all did he get for his apples? \$175.25

6. In a boat race one boat went 20.5 mi. in 25 min. What was its speed in miles per minute? (1) in miles per hour? (2) Give the answers to hundredths of a mile. (1) .82; (2) 49.20

7. Find the average weight of three girls with these weights: 73 lb., $75\frac{1}{2}$ lb., and $77\frac{1}{4}$ lb. $75\frac{1}{4}$

8. Last winter Jim sold a total of 68 doz. eggs and received \$33.07 for them. Find, to the nearest cent, the average selling price per dozen eggs. \$.49

9. In 6 months the total snowfall on Bearcat Mountain was 104 in. Find the average monthly snowfall on Bearcat Mountain to the nearest tenth of an inch. 17.3

10. A train and an airplane leave Chicago at the same time. The train's speed is 56 mi. per hour and the airplane's speed is 225 mi. per hour. In 3 hr. how much farther does the airplane go than the train? 507 mi.

How many problems did you get right? Look below to find out what your score means. Have pupils record scores and compare with previous ones to note improvements or weaknesses.

SCORE	0–5	6–7	8–9	10
	You need help	Fair	Good	Excellent

Remind pupils to read problems carefully (see page 212). Check papers and analyze errors. Confer with pupils who had mistakes to determine if they are using all problem aids they know, if they are using correct processes, if they are computing correctly.

Present diagnostic test of skills taught in
Chapter 6 with practice-page references.

How Much Have You Learned?

If you miss more than one example in a row, turn to the Practice Page for that row.

Practice Pages

Change these fractions to decimals:

1. $\frac{1}{2}$ .5 $\frac{3}{8}$ .375 $\frac{4}{5}$ .8 $\frac{7}{20}$ .35 $\frac{3}{25}$ .12 — 210

Change to decimals correct to the nearest hundredth:

2. $\frac{7}{8}$ .88 $\frac{5}{6}$ .83 $\frac{4}{9}$ .44 $\frac{2}{3}$ .67 $\frac{9}{11}$ .82 — 211

Multiply each number by 1000:

3. 29 29,000 6.3 6300 .084 84 2.71 2710 — 217

Divide each number by 100:

4. 872 8.72 26.7 .267 23 .23 3917 39.17 — 218

Divide, annexing zeros when necessary, until there is no remainder:

5. $\overset{.16}{4\overline{).64}}$ $\overset{.9}{3\overline{)2.7}}$ $\overset{4.2}{8\overline{)33.6}}$ $\overset{.103}{9\overline{).927}}$ — 200

6. $\overset{.615}{2\overline{)1.23\ 0}}$ $\overset{7.25}{4\overline{)29\ 00}}$ $\overset{35.4}{5\overline{)177\ 0}}$ $\overset{9.375}{8\overline{)75\ 000}}$ — 203

7. $\overset{9}{.4\overline{)3.6}}$ $\overset{7}{1.2\overline{)8.4}}$ $\overset{28}{.23\overline{)6.44}}$ $\overset{1.7}{3.8\overline{)6.46}}$ — 221

8. $\overset{.008}{6\overline{).048}}$ $\overset{.06}{4\overline{).24}}$ $\overset{1160}{.7\overline{)812\ 0}}$ $\overset{1700}{.08\overline{)136\ 00}}$ — 225

Divide. Carry the quotient to 2 decimal places; then round it off to the nearest tenth:

9. $\overset{3.1}{7\overline{)22\ 0}}$ $\overset{5.2}{6\overline{)31\ 0}}$ $\overset{3.8}{9\overline{)34\ 0}}$ $\overset{1.5}{27\overline{)39.2}}$ — 208

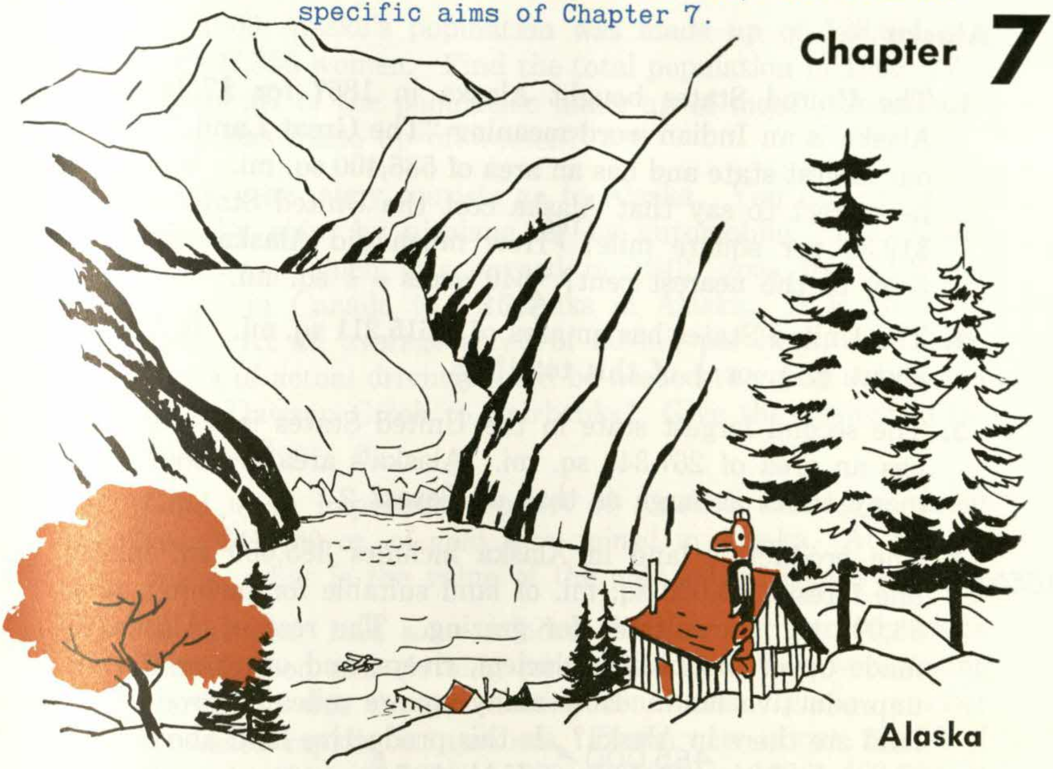
10. $\overset{228.3}{.6\overline{)137\ 00}}$ $\overset{5.3}{.9\overline{)4.77}}$ $\overset{3.4}{.7\overline{)2.391}}$ $\overset{226.4}{.11\overline{)24.9\ 00}}$ — 222

11. $\overset{246.7}{.03\overline{)7.4\ 00}}$ $\overset{5.8}{.06\overline{).35\ 0}}$ $\overset{385.7}{.007\overline{)2.7\ 000}}$ $\overset{253.3}{.009\overline{)2.28\ 00}}$ — 226

Check papers carefully and note types of errors. Return papers to pupils so they may find and correct errors (give help where needed). If reteaching is indicated, use materials to develop understandings.

Present problems dealing with geography, population, and products of Alaska and Hawaii (pages 233–236). See G-89 for specific aims of Chapter 7.

Chapter 7



Alaska

1. The coast of Southeast Alaska has some of the most wonderful scenery in the world. There are hundreds of islands, snow-covered mountains, beautiful bays bordered with steep cliffs, and enormous glaciers that crawl slowly to the sea. A glacier is a slow-moving river of ice that starts in high mountains. The largest glacier in Alaska has an area of 1500 sq. mi. The State of Rhode Island has a total area of 1214 sq. mi. This glacier covers how many more square miles than Rhode Island? 286

2. Where one glacier enters the sea it forms a great wall of ice 12 mi. wide and 750 ft. high. If a city building were 750 ft. high, how many stories would it have, allowing $12\frac{1}{2}$ ft. per story? 60

3. Although Alaska has hundreds of glaciers, they cover only .03 of its area of 586,400 sq. mi. How many square miles of Alaska's area are covered by glaciers? 17,592

Pupils should become better acquainted with Alaska, through social studies activities, before beginning problems on these pages. In connection with ex. 1, encourage pupils to find out further information on glaciers.

Alaska

1. The United States bought Alaska in 1867 for $7,200,000. Alaska is an Indian word meaning "The Great Land." It is our largest state and has an area of 586,400 sq. mi. Would it be correct to say that Alaska cost the United States about $12.30 per square mile? Yes How much did Alaska cost per acre, to the nearest cent? $.02 640 acres = 1 sq. mi.

2. The United States has an area of 3,615,211 sq. mi. Is Alaska about $\frac{1}{4}$, $\frac{1}{5}$, or $\frac{1}{6}$ of this total? $\frac{1}{6}$

3. The second largest state in the United States is Texas. It has an area of 267,340 sq. mi. Alaska's area is about how many times as large as that of Texas? 2

4. The productive land in Alaska includes 385,000 sq. mi. of fine forests, 65,000 sq. mi. of land suitable for farming, and 35,000 sq. mi. suitable for grazing. The rest of Alaska is made up of mountains, glaciers, rivers, and other relatively unproductive land. How many square miles of productive land are there in Alaska? 485,000 Is this productive land about $\frac{3}{4}$ or about $\frac{5}{6}$ of the total area of Alaska? $\frac{5}{6}$

5. Alaska has the highest mountain in North America, which is Mt. McKinley. It is 20,300 ft. high. Tom says that Mt. McKinley is almost 4 mi. high. Is Tom right? Yes How many feet less than 4 mi. high is Mt. McKinley? 820

6. The highest mountain in California is Mt. Whitney. Its height is 14,495 ft. Mt. McKinley is how many feet higher than Mt. Whitney? 5805 Is Mt. McKinley a mile, or over a mile, higher than Mt. Whitney? Over Name a mountain in the State of Washington over 14,000 ft. high. Mt. Rainier

7. The Yukon River is Alaska's longest and most important river; its length is 2300 mi. Of our other rivers only the Mississippi and the Missouri are longer than the Yukon. The Mississippi River is 2470 mi. long; the Missouri is 2432 mi. long. The length of the Yukon is how many miles less than that of the Mississippi? 170 than that of the Missouri? 132

Discuss these problems with pupils to develop understanding of problem situation. Encourage pupils to estimate answers first and label all answers.

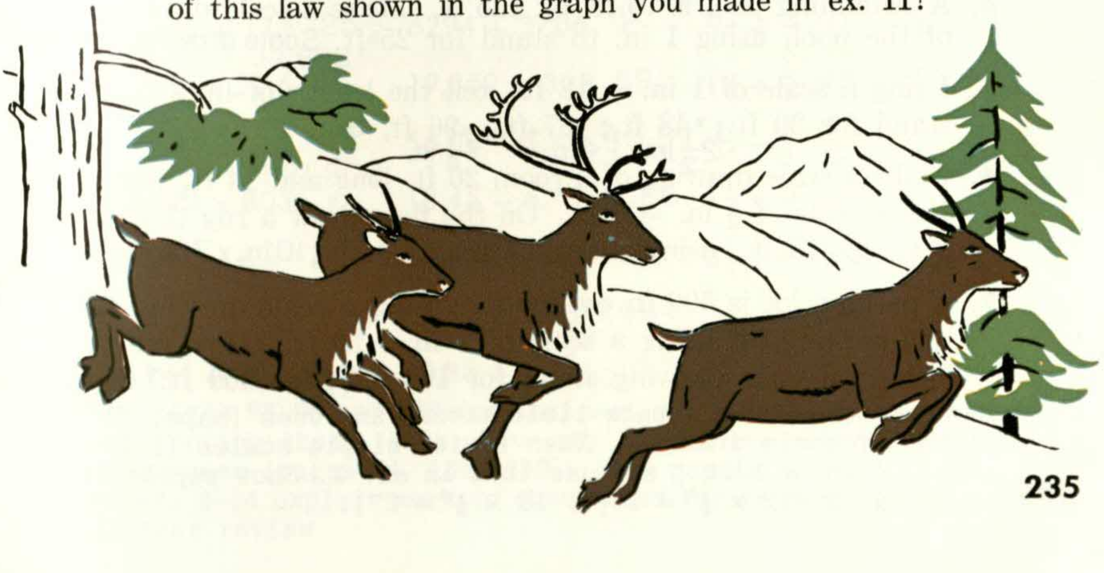
8. In 1960 Alaska's population was made up of 128,811 men and 97,356 women. Find the total population in 1960. 226,167 Was about .57 of the population made up of men? Yes About what part was made up of women? .43

9. Each year many tourists go to Alaska. You can make the trip by ship, by airplane, or by automobile. The Alaska Highway, which was opened in 1942, goes from Dawson Creek in Canada to Fairbanks in Alaska. It is 1523 mi. long. At an average speed of 30 mi. per hour, how many hours of actual driving would be needed to go by automobile from Dawson Creek to Fairbanks? Give the answer to the nearest hour. 51

10. Gold is an important product of Alaska. During a recent year 241,000 oz. of gold were mined in Alaska. At $35 an ounce, what is the value of the gold mined that year? $8,435,000

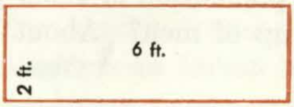
11. In the year 1891 some reindeer were brought to Alaska to furnish food and clothing for the Eskimos who were facing starvation due to poor fishing conditions. These reindeer increased rapidly in numbers. There were about 22,000 of them in 1910; 93,000 in 1920; 700,000 in 1930; 400,000 in 1940; and 100,000 in 1950. Draw a bar graph showing the numbers of reindeer in the years mentioned. Let 22,000 equal 25,000, and 93,000 equal 100,000.

12. In 1937 a law was passed forbidding the ownership of reindeer by anyone except the Eskimos and the Government. How many years ago was this law passed? How is the effect of this law shown in the graph you made in ex. 11?



Teach scale drawing of more difficult type than taught in Grade 5 (pages 236, 238, 240). Work should be omitted if time is limited, or if pupils do not have rulers. About 3 days will be needed to ensure understanding.

Scale Drawings

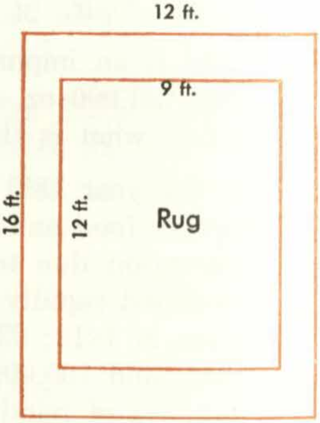


1. Here is a drawing of the top of the picnic table that Peter and his father made for their yard. The top is 2 ft. wide and 6 ft. long. Each $\frac{1}{4}$ in. on the drawing stands for 1 ft. How many inches stand for 2 ft.? $\frac{1}{2}$ for 6 ft.? $1\frac{1}{2}$ Measure the drawing with your ruler to see if it is right. Yes

Emphasize meaning.

This drawing is called a **scale drawing** and is made to the scale of $\frac{1}{4}$ in. = 1 ft. The scale may be written $\frac{1}{4}'' = 1'$.

In ex. 2, first ask pupils what 2 ft., 3 ft., 4 ft., stand for.



2. At the right is the plan that Bob drew of his room. The scale is $\frac{1}{8}'' = 1'$. How many inches stand for 12 ft.? $1\frac{1}{2}$ How many inches stand for 16 ft.? 2 Measure the plan to see if it is right. The rug on Bob's floor is 12 ft. long and 9 ft. wide. Did Bob draw the rug correctly to the scale of $\frac{1}{8}'' = 1'$? Yes

Give help as needed in all exercises.

3. Bob did not show the door and two windows that are in his room. If he had put them in the plan, how wide a space should he use in the drawing for the door, which is 3 ft. wide? $\frac{3}{8}$ in. How wide a space should he use for each window, if the windows are 2 ft. wide? $\frac{1}{4}$ in.

4. A swimming pool is 75 ft. by 125 ft. Make a scale drawing of the pool, using 1 in. to stand for 25 ft. Scale drawing: 3 ft. x 5 ft.

5. Using a scale of 1 in. = 12 ft., tell the length of lines that stand for 30 ft.; $2\frac{1}{2}$ in. 48 ft.; 4 in. 87 ft.; $7\frac{1}{4}$ in. 96 ft. 8 in.

6. Make a scale drawing of a room 20 ft. long and 14 ft. wide. Use a scale of $\frac{1}{2}$ in. = 1 ft. On the floor draw a rug that is 9 ft. by 15 ft., using the same scale. Room, 10 in. x 7 in.; rug, $4\frac{1}{2}$ in. x $7\frac{1}{2}$ in.

7. A parking lot is 500 ft. by 300 ft. Make a scale drawing of this parking lot using a scale of 1 in. = 50 ft. How many inches on your drawing stand for 100 ft.? 2 for 300 ft.? 6

First discuss need (space limitations) and uses (maps, floor plans) of scale drawings. Then review simple scales (1 in. = 1 ft., $\frac{1}{2}$ in. = 1 ft.) and use them in ex. 1. Show pupils how to do ex. 2 ($12 \times \frac{1}{8}'' = 1\frac{1}{2}''$, $16 \times \frac{1}{8}'' = 2''$).

Present set of improvement tests in multiplication and review basic skills in whole numbers and fractions.

Improving by Practice

Multiplication Test 4a.

Time: 5 min. after copying.

1.	4935	2186	2708	7629	3564	1543	
	53	38	74	19	26	98	⑥
	261,555	83,068	200,392	144,951	92,664	151,214	

Multiplication Test 4b.

Time: 5 min. after copying.

2.	3749	6178	5390	8974	1265	7416	
	78	51	64	92	57	36	⑥
	292,422	315,078	344,960	825,608	72,105	266,976	

Multiplication Test 4c.

Time: 5 min. after copying.

3.	2165	6403	3859	7298	4371	8934	
	29	54	17	65	83	94	⑥
	62,785	345,762	65,603	474,370	362,793	839,796	

Written Practice

Copy and work each example:

4.	437 × 956 417,772	42,000 − 956 41,044	$3\frac{1}{2} + \frac{3}{5}$ $4\frac{1}{10}$	$\frac{4}{5} \times 30$ 24
5.	900 − 847 53	61,344 ÷ 38 1614R12	$1\frac{3}{5} \div \frac{4}{5}$ 2	$9 - 2\frac{3}{8}$ $6\frac{5}{8}$
6.	287 + 469 756	\$4.95 + \$.89 \$5.84	$7\frac{1}{2} \times \frac{5}{6}$ $6\frac{1}{4}$	$7 \times 2\frac{1}{2}$ $17\frac{1}{2}$
7.	90 × 4365 392,850	22,150 ÷ 25 886	$6\frac{2}{3} - \frac{5}{6}$ $5\frac{5}{6}$	$\frac{3}{8} \times 1\frac{1}{2}$ $\frac{9}{16}$
8.	$13\frac{1}{2} + 11\frac{3}{4}$ $25\frac{1}{4}$	6294 + 3706 10,000	$9\frac{1}{4} + \frac{3}{4}$ 10	$3 \div 4\frac{1}{2}$ $\frac{2}{3}$
9.	.78 × 22.6 17.628	19,352 ÷ 328 59	$18 \div \frac{2}{5}$ 45	$\frac{5}{6} + \frac{11}{12}$ $1\frac{3}{4}$
10.	6.45 ÷ .15 43	\$6.00 − \$.43 \$5.57	$\frac{11}{16} - \frac{3}{8}$ $\frac{5}{16}$	$\frac{7}{8} - \frac{5}{16}$ $\frac{9}{16}$
11.	400 × 803 321,200	18.45 − 6.79 11.66	$1\frac{1}{6} \times 9$ $10\frac{1}{2}$	$\frac{1}{4} \div \frac{5}{12}$ $\frac{3}{5}$
12.	$16\frac{1}{2} - 8\frac{9}{10}$ $7\frac{3}{5}$	22,218 ÷ 483 46	$3\frac{1}{6} + \frac{3}{4}$ $3\frac{11}{12}$	$8 + 3\frac{1}{4}$ $11\frac{1}{4}$
13.	.08 × 11.2 .896	12.32 ÷ .005 2464	$\frac{15}{16} \div \frac{3}{4}$ $1\frac{1}{4}$	$1 - \frac{5}{16}$ $\frac{11}{16}$
14.	$14\frac{3}{4} + 4\frac{5}{6}$ $19\frac{7}{12}$	\$9.38 + \$.92 \$10.30	$10 - \frac{7}{8}$ $9\frac{1}{8}$	$6 \div \frac{9}{10}$ $6\frac{2}{3}$

See pages 55-58 and 328 for instructions on giving, recording, and scoring these tests. Have pupils compare scores with previous ones (pages 74, 139, 199). Have pupils who had errors in ex. 4-14 explain work to check need for reteaching or further review.

Point out that size of area to be shown, or size of object, and space available on paper influence choice of scale used.

Scale Drawings

1. A map is a scale drawing. Suppose two cities are $1\frac{1}{4}$ in. apart on a map where the scale is 1 in. = 80 mi. Find the airline distance between these cities. 100 mi.

2. Using a scale of $\frac{1}{4}$ in. to 1 mi., how long should the line be that stands for 10 mi.? $2\frac{1}{2}$ in. 20 mi.? 5 in.

3. Using a scale of 1 in. to 75 mi., how long should the line be that stands for a distance of 375 mi.? 5 in.

4. George was looking at a map of eastern United States. Its scale was 1 in. = 60 mi. With his ruler he measured the airline distance between Washington and Chicago and found it was 10 in. What is the distance between these two cities? 600 mi. What is the distance between cities that are $3\frac{1}{2}''$ apart on that map? 210 mi. that are $1\frac{3}{4}''$ apart? 105 mi. that are $7\frac{1}{4}''$ apart? 435 mi.

5. Get a map of your state and look for its scale. Use the scale to find the airline distances between several cities or towns shown on the map.

6. A baseball diamond is a square 90 ft. on a side. On paper draw a baseball diamond to the scale of 1 in. = 15 ft. Mark first base, second base, third base, and home plate on your drawing. Scale drawing, 6 in. x 6 in.

7. Draw another plan of a baseball diamond, letting the scale be $\frac{1}{2}$ in. = 10 ft. Scale drawing, $4\frac{1}{2}$ in. x $4\frac{1}{2}$ in.

Draw these rectangles to the scale of $\frac{1}{4}$ in. = 1 ft.:

8. 8 ft. × 12 ft. 2 in. x 3 in. 15 ft. × 18 ft. $3\frac{3}{4}$ in. x $4\frac{1}{2}$ in. 16′ × 20′ 4 in. x 5 in.

9. 6 ft. × 10 ft. $1\frac{1}{2}$ in. x $2\frac{1}{2}$ in. 24 ft. × 24 ft. 6 in. x 6 in. 14′ × 17′ $3\frac{1}{2}$ in. x $4\frac{1}{4}$ in.

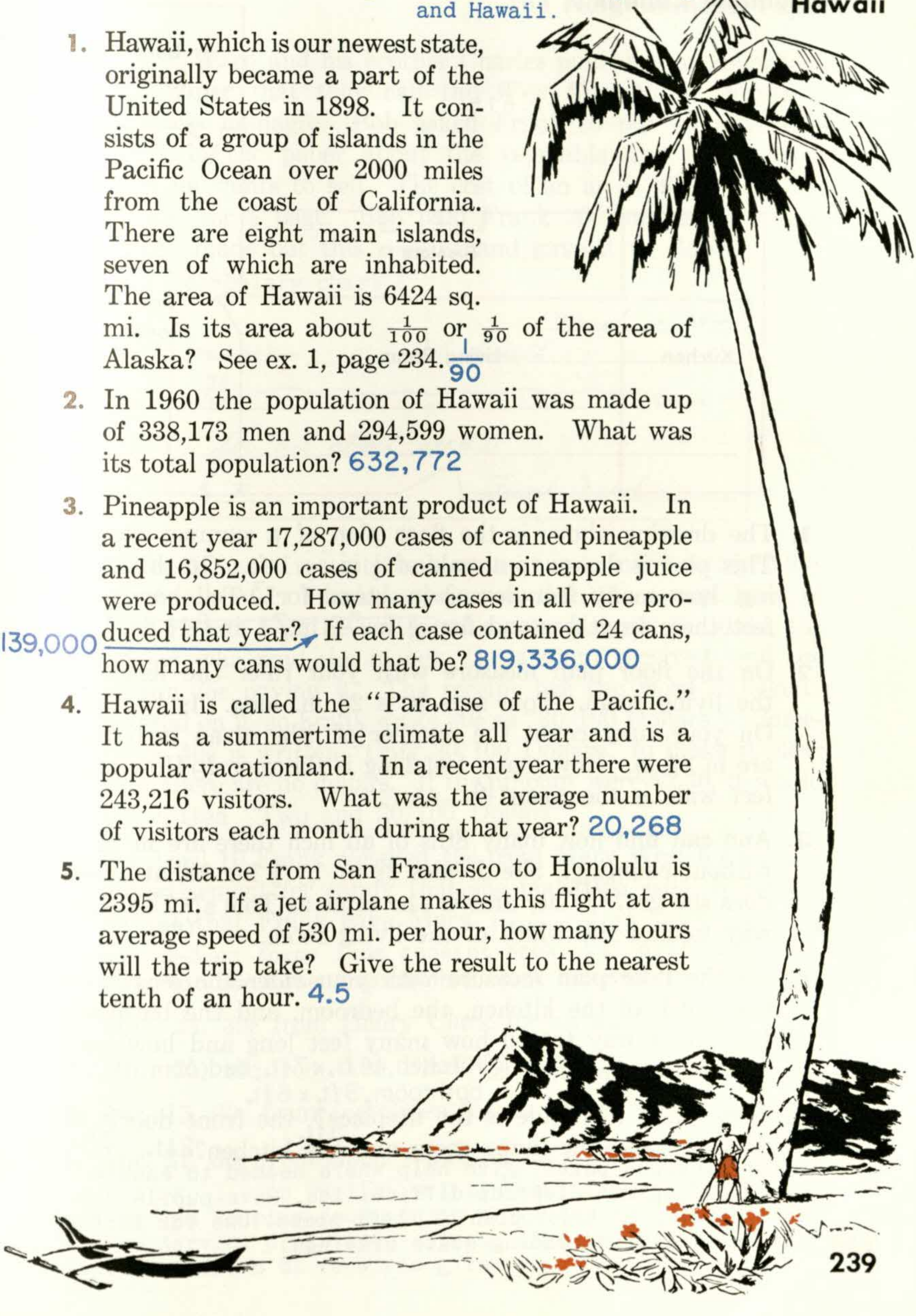
10. 4 ft. × 13 ft. 1 in. x $4\frac{1}{3}$ in. 20 ft. × 25 ft. 5 in. x $6\frac{1}{4}$ in. 12′ × 24′ 3 in. x 6 in.

11. 7 ft. × 19 ft. $1\frac{3}{4}$ in. x $4\frac{3}{4}$ in. 18 ft. × 30 ft. $4\frac{1}{2}$ in. x $7\frac{1}{2}$ in. 17′ × 22′ $4\frac{1}{4}$ in. x $5\frac{1}{2}$ in.

Be sure all work on page 236 is understood before beginning this page. Pupils should make all the drawings called for in ex. 6-11. Emphasize importance of measuring accurately and check to see that all pupils are doing work correctly.

Encourage pupils to find out further information on Hawaii and use it to make original problems, comparing Alaska and Hawaii.

Hawaii



1. Hawaii, which is our newest state, originally became a part of the United States in 1898. It consists of a group of islands in the Pacific Ocean over 2000 miles from the coast of California. There are eight main islands, seven of which are inhabited. The area of Hawaii is 6424 sq. mi. Is its area about $\frac{1}{100}$ or $\frac{1}{90}$ of the area of Alaska? See ex. 1, page 234. $\frac{1}{90}$

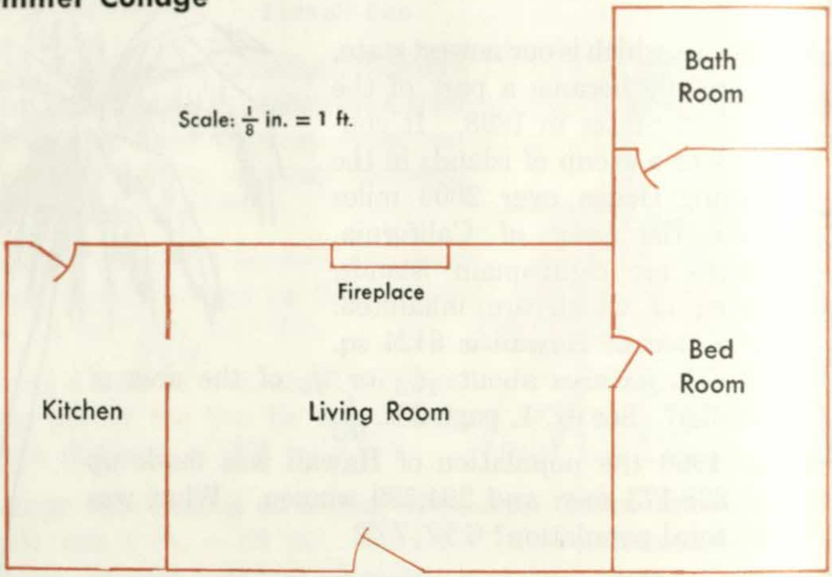
2. In 1960 the population of Hawaii was made up of 338,173 men and 294,599 women. What was its total population? 632,772

3. Pineapple is an important product of Hawaii. In a recent year 17,287,000 cases of canned pineapple and 16,852,000 cases of canned pineapple juice were produced. How many cases in all were produced that year? 34,139,000 If each case contained 24 cans, how many cans would that be? 819,336,000

4. Hawaii is called the "Paradise of the Pacific." It has a summertime climate all year and is a popular vacationland. In a recent year there were 243,216 visitors. What was the average number of visitors each month during that year? 20,268

5. The distance from San Francisco to Honolulu is 2395 mi. If a jet airplane makes this flight at an average speed of 530 mi. per hour, how many hours will the trip take? Give the result to the nearest tenth of an hour. 4.5

A Summer Cottage



1. The drawing above is the floor plan of a summer cottage. This plan is drawn to a scale of $\frac{1}{8}$ in. = 1 ft. On this drawing, how many feet does $\frac{3}{8}$ in. stand for? 3 Tell how many feet these lengths stand for: $\frac{5}{8}$ in., 5 $\frac{7}{8}$ in., 7 1 in., 8 $1\frac{1}{8}$ in. 9

2. On the floor plan measure with your ruler the length of the living room. Tom says it is $2\frac{3}{8}$ in. long. Is he right? Yes On your ruler count the number of 8ths of an inch there are in $2\frac{3}{8}$ in. How many feet long is the room? 19 How many feet wide is the room? 14

3. Ann can find how many 8ths of an inch there are in $2\frac{3}{8}$ in. without counting. She divides $2\frac{3}{8}$ in. by $\frac{1}{8}$ in. What answer does she get? 19 ft. Is her answer the same as Tom's? Yes Use Ann's way to find the width of the living room.

4. On the floor plan measure with your ruler the length and the width of the kitchen, the bedroom, and the bathroom. Use Ann's way to tell how many feet long and how many feet wide each room is. Kitchen, 14 ft. x 7 ft.; bedroom, 18 ft. x 9 ft; bathroom, 9 ft. x 6 ft.

5. How many feet wide is the fireplace? 5 ft. the front door? 3 ft. the door between the living room and the kitchen? 2 ft.

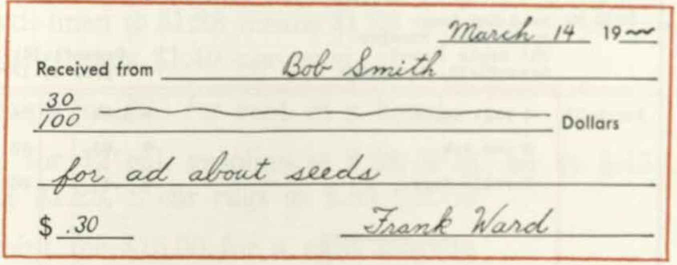
As for previous pages, give help where needed to ensure understanding and clear up difficulties. Have pupils make scale drawing of floor plan of their homes. Use for further class activity in reading scale drawings.

Show how receipts are written and give practice in writing them. If possible, display receipt book.

The Neighborhood Paper

1. Frank Ward and his brother Charles publish a neighborhood newspaper that they call the *West End News*. Frank is business manager. Bob asked Frank to put an advertisement in the paper about the vegetable and flower seeds that he wants to sell. The cost of an ad is 30¢ for $\frac{1}{4}$ page or 15¢ for $\frac{1}{8}$ page. Bob paid Frank 30¢ for his ad. Then Frank made out this **receipt** and gave it to Bob:

Post on vocabulary chart.



March 14 19—

Received from Bob Smith

$\frac{30}{100}$ ——— Dollars

for ad about seeds

$ .30 Frank Ward

Frank has a receipt book containing printed receipts like the one above. Frank keeps a record in the receipt book of each receipt that he writes; this record shows the date, the person who paid the money, the amount received, and the reason for paying it. The receipt has the word "Dollars" printed on it, so Frank wrote 30¢ as "30/100 Dollars." Sometimes 30¢ is written "Only 30/100 Dollars" to make it clear that there are no dollars. If the amount were \$2.30, it would be written "Two and 30/100 Dollars."

Emphasize

2. On April 10 Frank received 15¢ from Mary West for a small advertisement for candy that she makes to sell. Write the receipt that Frank gave Mary. Have pupils write receipts for ex. 2–3 on forms from receipt book. Let different pupils record receipts.

Write receipts for these amounts that Frank received:

3. Mar. 24, 30¢ from Henry Clark for an ad for eggs.

4. Mar. 25, 15¢ from Ann Black for a "lost" notice.

5. Apr. 15, 60¢ from Joe Green for an ad for magazines.

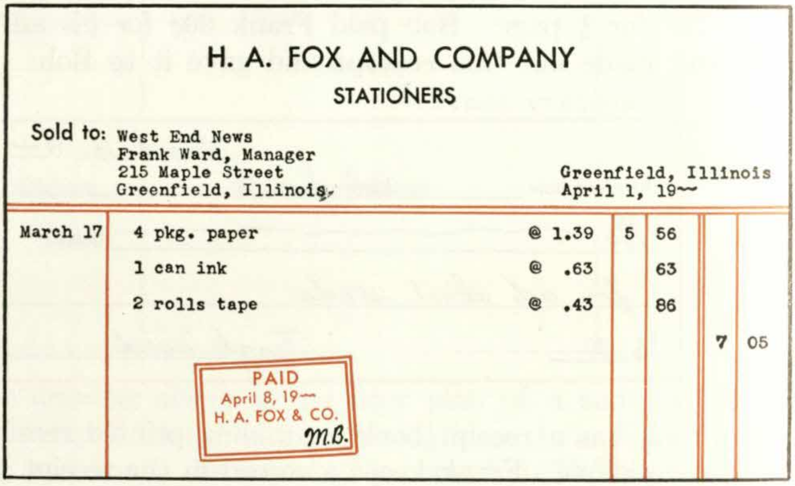
6. Apr. 21, 30¢ from Ellen White for an ad for greeting cards.

Discuss ex. 1 with pupils, pointing out importance of receiving and keeping receipts to prove that you have paid for the service or article. Stress also importance of keeping a record of receipts given.

Explain how bills are made out and give pupils practice in doing this (pages 242-243).

Bills for Purchases

1. Frank orders the supplies that are needed for the *West End News* and pays the bills when they come in. A business house usually sends out bills on the first of each month. Here is a bill that Frank received on April 2:



H. A. FOX AND COMPANY
STATIONERS

Sold to: West End News
Frank Ward, Manager
215 Maple Street
Greenfield, Illinois

Greenfield, Illinois
April 1, 19—

March 17	4 pkg. paper	@ 1.39	5	56		
	1 can ink	@ .63		63		
	2 rolls tape	@ .43		86		
					7	05

PAID
April 8, 19—
H. A. FOX & CO.
M.B.

In the bill the sign @ means "at"; 4 pkg. paper @ 1.39 means 4 packages of paper at $1.39 **each.** Have pupils explain the other purchases on the bill.

2. Check the bill to see if these amounts are correct: $5.56; $.86; $7.05. Yes Why should bills be checked?

3. When Frank paid the bill, it was stamped "Paid" together with the date of payment. When a bill has been marked "Paid," it is called a **receipted bill.** Emphasize.

4. Why should Frank save all receipted bills and keep them in a box or file?

5. Ask your parents or a business man to show you some receipted bills.

6. On March 1 Frank received from H. A. Fox and Co. a bill for these purchases on Feb. 20: 1 box file folders @ $1.98; 3 pkg. white cards 3 by 5 in. @ $.69; 2 typewriter ribbons @ $.85. Make out the bill. See G-92.

In ex. 1 have pupils note all items which should appear on bill: name and address of seller and buyer; dates of bill and purchase; itemized list of articles, total cost of each, total amount of bill.

Be sure pupils include all information which should be on correct bill or receipt.

Bills and Receipts

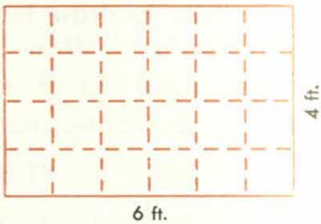
Use a ruler to draw forms for bills and receipts like those on pages 241 and 242. Write the following bills and receipts. In the bills find the total cost of each article and the total amount of the bill. Make up the dates, names, and addresses:

1. A receipt for $1.00 for club dues.
2. A bill for 4 yd. linen @ $1.28; 2 cards of buttons @ $.29; 1 pattern @ $.50; $\frac{1}{2}$ yd. trimming @ $1.40. $6.90

   ▶ 4 yd. linen @ $1.28 means $1.28 per yard. $\frac{1}{2}$ yd. trimming @ $1.40 means $1.40 per yard.
3. A receipt for $85 for rent of a house.
4. A bill for 12 gal. gasoline @ $.28, 6 qt. oil @ $.45, 1 fan belt @ $1.25, 2 car rugs @ $.89. $9.09
5. A receipt for $15.00 for a used bicycle.
6. A bill for $3\frac{1}{2}$ lb. meat @ $.47; $\frac{1}{2}$ lb. butter @ $.69; 2 doz. eggs @ $.56; 3 cans beans @ $.19. $3.69
7. A bill for 4 baseballs @ $1.49; 2 baseball bats @ $1.79; 2 fielder's gloves @ $4.67; 1 catcher's mitt @ $7.95. $26.83
8. A bill for 4 gal. house paint @ $3.98; 3 paint brushes @ $1.83; 2 gal. paint thinner @ $.94; 2 qt. trim paint @ $1.85. Receipt this bill. $26.99

Use scale drawings to help in discovery of method of determining area of rectangle.

Finding Areas



1. On the right is a scale drawing of a rectangle. It stands for a rectangle whose length is 6 ft. and whose width is 4 ft. The scale used is $\frac{1}{4}$ in. = 1 ft. To measure the area of this rectangle, you want to know how many square feet it contains. You have learned to find the area of a rectangle by multiplying its length by its width. What is the area of this rectangle? 24 sq. ft.

Check the area of this rectangle by counting the squares formed by the dotted lines in the scale drawing. What does each one of these squares stand for? 1 sq. ft.

2. Make a scale drawing of a rectangle with a length of 20 ft. and a width of 12 ft.(1) Use the scale $\frac{1}{2}'' = 1'$. Find the area of this rectangle and check by putting dotted lines in your drawing and counting the squares as in ex. 1.(2) (1) Scale drawing, 10 in. by 6 in.; (2) 240 sq. ft.

3. Make a scale drawing of a rectangle with a length of 60 mi. and a width of 50 mi.(1) Use the scale 1 in. = 10 mi. What is the area of this rectangle?(2) (1) Scale drawing, 6 in. by 5 in.; (2) 3000 sq. mi.

4. Find the area of a rectangle having a length of 8 ft. and a width of 3 ft. 6 in. 28 sq. ft.

▶ You must first express both dimensions of the rectangle in the same unit. So change 3 ft. 6 in. to $3\frac{1}{2}$ ft. Then multiply 8 by $3\frac{1}{2}$.

To find the area of a rectangle, you can use the formula: $A = lw$. What does lw mean?

Assign ex. 5–7 as independent work, but give help as needed.

Find the areas of these rectangles. Remember to express both dimensions in the same unit: Emphasize.

5.	5 in. × 16 in. 80 sq. in.	7 ft. 6 in. × 10 ft. 75 sq. ft.	5.8 mi. × 14 mi. 81.2 sq. mi.
6.	7 ft. × 39 ft. 273 sq. ft.	6 ft. 3 in. × 20 ft. 125 sq. ft.	1.8 in. × 2.4 in. 4.32 sq. in.
7.	7 yd. × 18 yd. 126 sq. yd.	2 yd. 1 ft. × 11 yd. $25\frac{2}{3}$ sq. yd.	3.7 mi. × 4.2 mi. 15.54 sq. mi.

Review quickly work on pages 238–240. Then follow development as given. Emphasize that area is amount of space covered by a surface. In ex. 3, review meaning of sq. mi. (square whose sides are 1 mi. each).

Present problems in finding area of rectangle. Let different pupils read problems, and discuss solutions with class. Then have pupils complete solutions.

Finding Areas

1. Next fall Mr. Wood is going to make a lawn at the rear of his house. The space is 45 ft. wide and 60 ft. long. (2700sq.f He will need 1 lb. of seed for each 200 sq. ft. of lawn. How many pounds of seed should he buy?

2. Mr. West has $\frac{1}{2}$ acre of land to plant this spring. (21,780sq.ft.) He wants to buy ground limestone to put on it and finds that he needs 100 lb. of limestone for each 1000 sq. ft. of land. How many pounds of limestone does he need? 2178 Remember that an acre contains 43,560 sq. ft.

3. If Mr. West buys the limestone in 100-pound bags, how many bags of limestone will he have to buy? 21.78, or 22 Find the cost at \$.85 per bag. \$18.70

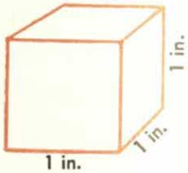
4. Mr. Grant wants to put lawn food on his lawn. The lawn is 65 ft. by 75 ft. (4875 sq.ft.) He needs 8 lb. for every 100 sq. ft. of lawn. How many pounds of lawn food does he need? 390

5. Mr. Grant can buy the lawn food in bags of 80 lb. each at \$3.25. How many bags should he buy? $4\frac{7}{8}$ or 5 How many pounds of lawn food will he have left over? 10 Find the cost. \$16.25

6. Across the street from Fairfield School is a lot containing $\frac{1}{4}$ acre that is used for school gardens. (10,890 sq.ft.) If each garden contains about 50 sq. ft., how many gardens can there be? $217\frac{4}{5}$, or 218 Give your answer to the nearest whole number.

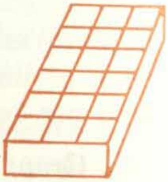
Teach pupils how to find volumes of rectangular solids and develop table of cubic measure (pages 246-249).

Finding Volumes



1. A small block 1 inch wide, 1 inch long, and 1 inch high is called an **inch cube** because each of the three dimensions is 1 inch. The block **contains** 1 cubic inch; so its **volume** is 1 **cubic inch,** or 1 **cu. in.**

2. Problem Henry has an empty box 3 in. wide, 6 in. long, and 1 in. deep. How many inch cubes like that in ex. 1 will it take to fill the box? 18 How many cubic inches does the box contain? 18



Explanation You see from the drawing that there is a row containing 3 **inch cubes** across the width of the box and that it takes 6 of these rows to fill the box. So the box contains 6 × 3, or 18, inch cubes. This means that the box has a volume of 18 cu. in.

3. Jim has a box 3 in. wide, 6 in. long, and 2 in. deep. Since it is 2 in. deep it will hold 2 layers of inch cubes. Each layer contains 18 inch cubes, so 2 layers contain 2 × 18, or 36, inch cubes. Then Jim's box has a volume of 36 cu. in.
▶ A short way to get 36 is to multiply the dimensions like this: $2 \times 6 \times 3 = 36$.

Be sure pupils understand meaning of rectangular solid.

4. Things shaped like an ordinary box are called **rectangular solids. To find the volume of a rectangular solid, multiply its length by its width by its height.** Emphasize. If you let V stand for the volume of a rectangular solid, l for its length, w for its width, and h for its height, the formula for its volume is: $V = lwh$. Remember that lwh means $l \times w \times h$.

Have pupils draw representative diagrams for ex. 5-7.

Find the volumes of boxes with these dimensions:

5. 2 in. × 3 in. × 7 in. 42 cu. in.

6. 3 in. × 5 in. × 9 in. 135 cu. in.

7. $\frac{1}{2}$ in. × 4 in. × 4 in. 8 cu. in.

11 in. × 14 in. × 20 in. 3080 cu. in.

12 in. × 12 in. × 15 in. 2160 cu. in.

$2\frac{1}{2}$ in. × 10 in. × 12 in. 300 cu. in.

Use boxes (have pupils measure dimensions) and inch cubes to fill the boxes to develop concept of volume. Before discussing generalization in ex. 4, let pupils use inch cubes to find volumes of various boxes and discover "short way" of doing it.

Finding Volumes

1. When Peggy bought her mother a birthday gift, the store packed it in a box 1 ft. long, 1 ft. wide, and 1 ft. high. Since all the dimensions of the box are 1 ft., the box is a **cube.** Its **volume** is 1 **cubic foot,** or 1 **cu. ft.**

2. A box is 3 ft. wide, 4 ft. long, and 2 ft. high. How many cubic feet does it contain? 24

3. Which box holds more, one that is 1 ft. × 2 ft. × 3 ft. (6 cu. ft.) or one that is 2 ft. × 2 ft. × 2 ft.? (8 cu. ft.); second box holds more.

4. A very large box, shaped like a cube, might have its width, its length, and its height all 1 yd. Then it would contain 1 **cubic yard,** or 1 **cu. yd.** You see that three measures of volume are the **cubic inch,** the **cubic foot,** and the **cubic yard.** Name an object, shaped like a box, whose volume might be measured by the cubic inch. Name an object whose volume might be measured by the cubic foot.

5. Dick and his father made a wooden box in which to ship some books. The box is 4 ft. long, 18 in. wide, and 1 ft. deep. Find the volume of the box. 6 cu. ft.

▶ When finding volume, all dimensions must be expressed in the same unit of measure. First change 18 in. to $1\frac{1}{2}$ ft. Then all the dimensions will be in **feet.**

Have pupils make representative diagrams for ex. 6–8.

Find these volumes. If necessary, express all dimensions in the same unit before multiplying: Stress.

6. 5′ × 8′ × 3′ 120 cu. ft. 3′ × 6′ × 6″ 9 cu. ft. 8″ × 3′ × 6″ 1 cu. ft.

7. 6″ × 9″ × 4″ 216 cu. in. 4′ × 5′ × 9″ 15 cu. ft. 6″ × 4′ × 3″ $\frac{1}{2}$ cu. ft.

8. 3″ × 8″ × 2″ 48 cu. in. 2′ × 8″ × 18″ 2 cu. ft. 18″ × 8′ × 1′ 12 cu. ft.

More Practice. See (50) on page 326. Use to reinforce understanding.

Discuss ex. 1–5 thoroughly with pupils, emphasizing fact that each of the three dimensions must be expressed in same unit of measure. If possible, try to display box that has volume of 1 cubic foot. Have pupils do ex. 6–8 independently.

Measures of Volume

1. When the three dimensions of a cube are each 1 ft., the volume is 1 cu. ft. If you change 1 ft. to 12 in., the dimensions become 12 in. × 12 in. × 12 in., and the volume is 1728 cu. in. This shows that 1 cu. ft. equals 1728 cu. in.

2. When the three dimensions of a cube are each 1 yd., the volume is 1 cu. yd. If you change 1 yd. to 3 ft., the dimensions then become 3 ft. × 3 ft. × 3 ft., and the volume is 27 cu. ft. This shows that 1 cu. yd. equals 27 cu. ft.

3. Learn this table of **cubic measure.** It tells how measures of volume are related:

Emphasize after understanding is assured.

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.)
27 cubic feet (cu. ft.) = 1 cubic yard (cu. yd.)

4. How many cubic inches are there in 3 cu. ft.? 5184 in $2\frac{1}{2}$ cu. ft.? 4320

5. How many cubic feet are there in 5 cu. yd.? 135 in $3\frac{1}{2}$ cu. yd.? $94\frac{1}{2}$

6. How many cubic yards are there in 54 cu. ft.? 2 in 81 cu. ft.? 3 in 162 cu. ft.? 6 in 18 cu. ft.? $\frac{2}{3}$

7. Is a volume of 5000 cu. in. more or less than 3 cu. ft.? Less (3 cu. ft. = 5184 cu. in.)

8. Bob made out of redwood a window box in which to grow flowers. It is 24 in. long, 9 in. wide, and 8 in. deep. ($\frac{7}{8}$ cu. ft.) He is going to fill it with soil to within 1 in. of the top. Does he need more or less than 1 cu. ft. of soil? Less

9. Mr. Booth had a basement dug for his new house. The basement is 33 ft. long, 18 ft. wide, and 8 ft. deep. How many cubic yards of earth had to be removed? 176

10. In a schoolroom there should be 200 cu. ft. of air space for each pupil. Jack's schoolroom is 30 ft. long, 25 ft. wide, and 12 ft. high. How much air space does it have? 9000 cu. ft. Is that air space enough for the 26 pupils in Jack's room? Yes (26 × 200 cu. ft. = 5200 cu. ft.)

Draw diagrams on blackboard to illustrate relationships in ex. 1-2 and to develop understanding. Pupils should do the multiplications themselves to discover equivalents in ex. 3. Have pupils explain their work in ex. 4-10.

Measuring Liquids

1. A gallon of liquid fills a space of 231 cu. in. A rectangular tank is 11 in. wide, 21 in. long, and 12 in. deep. (2772 cu. in.) How many gallons of water are needed to fill it full of water? 12

▶ First find the volume of the tank in cubic inches. Since 1 gal. of water will fill a space of 231 cu. in., divide the number of cubic inches of volume by 231. This gives the number of gallons needed to fill the tank.

2. Peter has a glass tank in which he keeps goldfish. The tank is 6 in. wide, 11 in. long, and 8 in. deep. (462 cu. in.) He fills it with water to within 1 in. of the top. How many gallons of water does Peter put in the tank? 2

3. If a rectangular can has a width of $3\frac{1}{2}$ in. and a length of 6 in., how many inches high should it be to hold 1 gal.? 11 Do you think the can should be exactly that number of inches high? Give a reason for your answer. Answers will vary.

4. If a rectangular can is $5\frac{1}{2}$ in. wide, 7 in. long, and $12\frac{1}{8}$ in. high, (1) will it hold 1 gal. or 2 gal. when filled? (2) (1) $466\frac{13}{16}$ cu. in.; (2) close to 2 gal.

5. It takes about $7\frac{1}{2}$ gal. of water to fill the space occupied by 1 cu. ft. If a rectangular tank is 6 ft. long, 3 ft. wide, and 4 ft. deep, (72 cu. ft.) how many gallons of water are needed to fill it full of water? 540

6. Workmen finished digging a ditch $2\frac{1}{2}$ ft. wide and 90 ft. long. Soon after that a heavy rain flooded the ditch. If the water was 8 in. deep, (150 cu. ft.) how many gallons of water fell in the ditch? 1125

7. How many cubic inches does a quart occupy? $57\frac{3}{4}$, or 58 a pint? $28\frac{7}{8}$, or 29 Give your answer to the nearest cubic inch. 1 gal. = 231 cu. in.

Here are the dimensions of some rectangular cans. Which cans hold about a pint? Which cans hold about a quart?

8. $6'' \times 6'' \times 1\frac{5}{8}''$ $58\frac{1}{2}$ cu. in., about 1 qt. — $3\frac{1}{2}'' \times 5'' \times 1\frac{3}{4}''$ $30\frac{5}{8}$ cu. in., about 1 pt. — $2\frac{3}{4}'' \times 6'' \times 1\frac{7}{8}''$ $30\frac{15}{16}$ cu. in., about 1 pt.

9. $2'' \times 4'' \times 7\frac{3}{8}''$ 59 cu. in., about 1 qt. — $3\frac{1}{4}'' \times 5'' \times 1\frac{7}{8}''$ $30\frac{15}{32}$ cu. in., about 1 pt. — $5\frac{1}{2}'' \times 8'' \times 1\frac{3}{8}''$ $60\frac{1}{2}$ cu. in., about 1 qt.

Do ex. 1-7 with pupils. In ex. 5 show pupils that 1 cu. ft.= "about" $7\frac{1}{2}$ gal.: since there are 1728 cu. in. in 1 cu. ft., divide 1728 by 231. Answer is $7\frac{111}{231}$, which is "about" $7\frac{1}{2}$. Assign ex. 8-9 as independent work.

Present applications of volume in problems. Let pupils do problems independently to see if they can apply skills learned, in finding volume, to problems. Have volunteers explain answers.

The Swimming Pool

1. The new high school in Maplewood has a swimming pool. Sixth grade pupils use it once a week. The pool is 60 ft. long and 35 ft. wide. The water in the pool is, on the average, 6 ft. deep. How many cubic feet of water are there in the pool? 12,600 How many gallons of water are there if 1 cu. ft. of water equals about $7\frac{1}{2}$ gal.? 94,500

2. The cost of water in Maplewood is 18¢ per 100 cu. ft. What does it cost for the water in the high school pool? See ex. 1. 2268¢, or $22.68

3. The outdoor pool in Grant Park is 90 ft. long and 40 ft. wide. If the pool is filled so that the water is, on the average, 6 ft. deep, (21,600 cu. ft.) what does the water cost at 24¢ per 100 cu. ft.? 5184¢, or $51.84 at 16.5¢ per 100 cu. ft.? 3564¢, or $35.64

4. How many gallons of water can be saved (2) if the pool in Grant Park is filled so that the water is, on the average, only 5 ft. 8 in. deep? (1) See ex. 3. (1) 20,400 cu. ft.; (2) 9000 gal.

Provide set of improvement tests in division. Review basic vocabulary and concepts.

Improving by Practice

Division Test 4a.

Time: 5 min. after copying.

1. $\begin{array}{r}450\frac{2}{3}\\63\overline{)28392}\end{array}$ $\quad$ $\begin{array}{r}962\\37\overline{)35594}\end{array}$ $\quad$ $\begin{array}{r}835\\49\overline{)40915}\end{array}$

2. $\begin{array}{r}827\frac{1}{4}\\24\overline{)19854}\end{array}$ $\quad$ $\begin{array}{r}713\frac{17}{58}\\58\overline{)41371}\end{array}$ $\quad$ $\begin{array}{r}609\\72\overline{)43848}\end{array}$ ⑥

Division Test 4b.

Time: 5 min. after copying.

3. $\begin{array}{r}569\\41\overline{)23329}\end{array}$ $\quad$ $\begin{array}{r}308\\38\overline{)11704}\end{array}$ $\quad$ $\begin{array}{r}295\frac{3}{8}\\56\overline{)16541}\end{array}$

4. $\begin{array}{r}847\frac{11}{19}\\19\overline{)16104}\end{array}$ $\quad$ $\begin{array}{r}786\frac{1}{5}\\25\overline{)19655}\end{array}$ $\quad$ $\begin{array}{r}490\\63\overline{)30870}\end{array}$ ⑥

Division Test 4c.

Time: 5 min. after copying.

5. $\begin{array}{r}604\\52\overline{)31408}\end{array}$ $\quad$ $\begin{array}{r}517\frac{3}{4}\\36\overline{)18639}\end{array}$ $\quad$ $\begin{array}{r}921\frac{1}{2}\\18\overline{)16587}\end{array}$

6. $\begin{array}{r}762\\27\overline{)20574}\end{array}$ $\quad$ $\begin{array}{r}830\frac{10}{43}\\43\overline{)35700}\end{array}$ $\quad$ $\begin{array}{r}349\\35\overline{)12215}\end{array}$ ⑥

To the Teacher. In ex. 1–6, pupils should write any remainder as a fraction in the quotient.

Do You Know the Right Word?

Read each sentence and tell the right word or words to complete it. Then write these words on paper:

7. The average of 18, 31, 26, and 29 is 26.

8. In 34.29, the 9 is in hundredths place.

9. In $\frac{3}{4} + \frac{1}{8}$, 8 is the common denominator.

10. When you round off 3.76 to the nearest tenth, you get 3.8.

11. A square 11 ft. on a side has a perimeter of 44 ft.

12. When you write $\frac{3}{4}$ as $\frac{4}{3}$, you invert the fraction.

13. 24 sq. ft. is the area of a rectangle 3 ft. by 8 ft.

14. You say 684 is divisible by 9 because 18 is divisible by 9.

15. To say that 19×42 is about 800, you estimate the answer.

See previous division test pages for suggestions and procedure (pages 95, 139, 199). Pupils who do poorly on ex. 7-15 should explain their answers so you may determine need for further review or redevelopment of concepts.

Review decimal fractions and 3-figure divisors in long division. Explain to pupils that content of problems determines form of answer.

Review of Division

1. In March Mrs. Hatch spent \$115.94 in all for food. What was the average amount she spent for food per day? March has 31 days. \$3.74

2. Mr. Clark uses his car in his business. Last year he drove it 14,716 mi. in all. What was the average number of miles he drove per week? 1 yr. = 52 wk. 283

3. A train made the trip of 2264 mi. from Chicago to San Francisco in 48 hr. Find its speed in miles per hour, correct to the nearest tenth of a mile. 47.16, or 47.2

4. The public library bought 217 books at a cost of \$925. Find the average cost per book, correct to the nearest cent. \$4.262, or \$4.26

5. In the schools of Mayfield this year there are 12,414 pupils and 387 teachers. On the average, about how many pupils per teacher are there in Mayfield? 32.0, or about 32

6. An airplane flew a distance of 2900 mi. in 7 hr. Find the speed of the plane in miles per hour. Carry your answer to the nearest hundredth of a mile. 414.285, or 414.29

Divide. Check by multiplying: Emphasize importance of checking carefully.

7.	$\overset{72}{41\overline{)2952}}$	$\overset{290\text{ R21}}{96\overline{)27861}}$	$\overset{57}{214\overline{)12198}}$	$\overset{334}{647\overline{)216098}}$
8.	$\overset{65}{23\overline{)1495}}$	$\overset{390\text{ R14}}{34\overline{)13274}}$	$\overset{29}{483\overline{)14007}}$	$\overset{258}{603\overline{)155574}}$
9.	$\overset{38\text{ R12}}{29\overline{)1114}}$	$\overset{467\text{ R8}}{86\overline{)40170}}$	$\overset{68\text{ R19}}{279\overline{)18991}}$	$\overset{764}{152\overline{)116128}}$
10.	$\overset{27\text{ R5}}{38\overline{)1031}}$	$\overset{305\text{ R25}}{94\overline{)28695}}$	$\overset{38\text{ R132}}{339\overline{)13014}}$	$\overset{525\text{ R240}}{868\overline{)455940}}$
11.	$\overset{37}{62\overline{)2294}}$	$\overset{324}{31\overline{)10044}}$	$\overset{83\text{ R24}}{189\overline{)15711}}$	$\overset{501}{718\overline{)359718}}$
12.	$\overset{42\text{ R17}}{67\overline{)2831}}$	$\overset{803\text{ R22}}{98\overline{)78716}}$	$\overset{37\text{ R20}}{715\overline{)26475}}$	$\overset{375\text{ R230}}{685\overline{)257105}}$
13.	$\overset{25\text{ R19}}{74\overline{)1869}}$	$\overset{4008}{19\overline{)76152}}$	$\overset{28}{626\overline{)17528}}$	$\overset{719\text{ R201}}{399\overline{)287082}}$
14.	$\overset{49\text{ R37}}{86\overline{)4251}}$	$\overset{2465\text{ R8}}{18\overline{)44378}}$	$\overset{86\text{ R29}}{471\overline{)40535}}$	$\overset{460}{382\overline{)175720}}$

In ex. 3-6 point out to pupils that when data in problem can be expressed fractionally, answer can become a fraction. Use ex. 5 to illustrate that when data cannot be expressed as fraction, answer is expressed to nearest whole number.

Provide comprehensive review of decimal fractions and mixed decimals.

Review of Decimals

Add and check your work:

1.	.75	8.7	0.80	11.24	2346.5	1946.0
	.36	7.4	0.33	3.75	1885.7	973.8
	1.11	16.1	1.13	14.99	4232.2	2919.8
2.	.90	4.1	0.84	16.35	8006.3	5584.0
	.46	3.2	0.39	4.67	6989.5	4945.5
	1.36	7.3	1.23	21.02	14,995.8	10,529.5

3. Work ex. 1 and 2 again, subtracting the numbers. Ex. 1: .39, 1.3, 0.47, 7.49, 460.8, 972.2; ex. 2: .44, 0.9, 0.45, 11.68, 1016.8, 638.5

4. Change these fractions to decimals:

$\frac{1}{4}$ .25 $\frac{3}{8}$ .375 $\frac{3}{4}$ .75 $\frac{1}{2}$ .5 $\frac{7}{10}$ .7 $\frac{3}{100}$ .03 $\frac{41}{1000}$ .041 $\frac{9}{1000}$ .009

5. Change to decimals correct to the nearest tenth:

$\frac{1}{3}$ .3 $\frac{4}{7}$ .6 $\frac{5}{6}$ .8 $\frac{2}{9}$ .2 $\frac{11}{15}$ .7 $\frac{8}{19}$ .4 $\frac{15}{23}$ .7 $\frac{7}{29}$ .2

6. Which decimal is larger?

.8 or .79 .8 .61 or .625 .625 .6 or .525 .6 .8 or .798 .8

7. Change these decimals to fractions:

.35 $\frac{7}{20}$ .75 $\frac{3}{4}$ .625 $\frac{5}{8}$ .6 $\frac{3}{5}$ .84 $\frac{21}{25}$ .875 $\frac{7}{8}$

Which is larger, the fraction or the decimal? First change the fraction to a decimal: Stress.

8. $\frac{1}{4}$ or .27 .27 $\frac{1}{3}$ or .330 $\frac{1}{3}$ $\frac{3}{8}$ or .371 $\frac{3}{8}$ $\frac{2}{3}$ or .669 .669

9. $\frac{3}{4}$ or .69 $\frac{3}{4}$ $\frac{5}{8}$ or .655 .65 $\frac{1}{3}$ or .355 .355 $\frac{7}{8}$ or .835 $\frac{7}{8}$

Divide and check your work:

10. 8.71 ÷ 6.7 1.3 1.1 ÷ .25 4.4 95.7 ÷ 1.65 58 .204 ÷ .012 17

11. 40.3 ÷ .62 65 9.6 ÷ .25 38.4 80.6 ÷ .124 650 .368 ÷ 11.5 .032

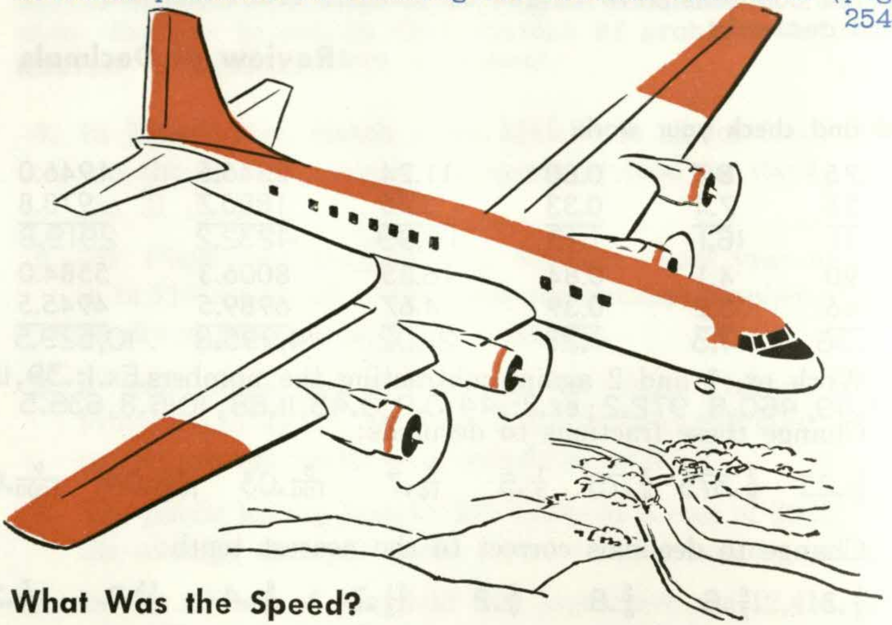
12. 31.8 ÷ .03 1060 6.6 ÷ 1.5 4.4 8.84 ÷ 13.6 .65 9.18 ÷ 10.8 .85

Multiply and check your work:

13.	6.9	.85	7.25	1.2	14.75	1348
	.8	.7	2.5	.06	4.5	.125
	5.52	.595	18.125	.072	66.375	168.500

Check papers carefully to determine types of errors. Through conferences with pupils who had errors, determine need for reteaching or further review. Plan remedial work as needed.

Continue practice in rounding off decimal fractions (pages 254-256).



What Was the Speed?

1. An airplane made a flight of 1639 mi. in 6 hr. If you are asked to find its speed in miles per hour, correct to the **nearest whole mile,** you divide 1639 by 6 and carry the quotient to one decimal place. This gives 273.1. Rounding off, you find that the speed of the airplane was 273 mi. per hour, correct to the nearest whole mile. If the quotient were 273.8, the speed would be 274 mi. per hour, correct to the nearest whole mile.

2. If you wish to give the speed of the airplane in ex. 1 correct to the nearest tenth of a mile per hour, you carry the quotient to two decimal places. This gives 273.16. Rounding off, you find the speed was 273.2 mi. per hour, correct to the nearest tenth of a mile.

3. Each year faster and better airplanes are being built. They make it possible to reduce the time necessary to make a trip such as flying across our country from California to the Atlantic Coast. In 1925 a non-stop flight from Los Angeles to New York took 27 hr. to cover the distance of 2464 mi. How many miles per hour, to the nearest whole mile, was the speed on that flight? 91

In discussing ex. 1-3, emphasize that decimal in quotient is expressed to one more decimal place than is needed in the answer.

4. In 1935 the time for the non-stop flight of 2464 mi. from Los Angeles to New York was reduced to 11 hr. 6 min. Find, to the nearest whole mile per hour, the speed on that trip. 222 mi. Since 6 min. = .1 hr., change 11 hr. 6 min. to 11.1 hr. Then divide 2464 by 11.1.

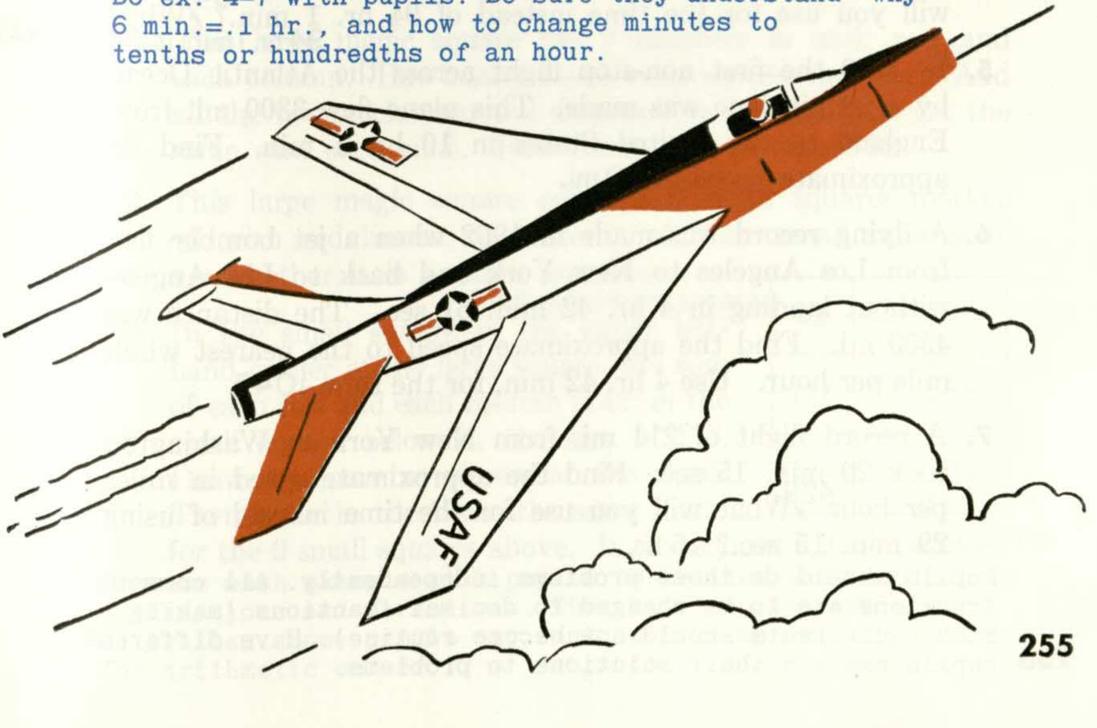
5. Now the trip of 2464 mi. from Los Angeles to New York in a non-stop jet passenger plane takes 4 hr. 30 min. Find the speed on this trip in miles per hour, correct to the nearest whole mile. 548 Change 4 hr. 30 min. to 4.5 hr. before dividing.

6. In 1955 a jet airplane made a flight of 2337 mi. from Riverside, California, to Philadelphia in 3 hr. 58 min. Find, to the nearest whole mile per hour, the **approximate** speed of this plane. 584 An **approximate** answer is one that is close to the actual answer. Since 58 min. is very close to 60 min. you can use 4 hr. for the time instead of 3 hr. 58 min. if you wish only an approximate answer. Why is an approximate answer often easier to get than the actual answer?

Emphasize meaning.

7. An Army airplane made a flight of 2454 mi. in 5 hr. 28 min. Find, to the nearest whole mile per hour, the **approximate** speed of that plane? 446 What is the time you will use instead of 5 hr. 28 min.? 5.5 hr.

Do ex. 4–7 with pupils. Be sure they understand "why" 6 min. = .1 hr., and how to change minutes to tenths or hundredths of an hour.



Some Famous Flights

1. In 1927 Charles Lindbergh made his famous non-stop flight across the Atlantic Ocean from New York to Paris, covering a total distance of 3647 mi. in $33\frac{1}{2}$ hr. Find, to the nearest whole mile per hour, his average speed. 109 Change $33\frac{1}{2}$ hr. to 33.5 hr. before dividing.

2. In 1939 Howard Hughes flew from New York to Paris in $16\frac{1}{2}$ hr., covering a distance of 3641 mi. Find his speed to the nearest whole mile per hour. 221 His speed was about how many times as fast as that of Lindbergh for the same trip? 2 To what time will you change $16\frac{1}{2}$ hr.? 16.5

3. In 1939 Howard Hughes made a record trip around the world, his total flying time being 71 hr. The total distance covered on this trip was 14,824 mi. Find his speed to the nearest whole mile per hour. 209 The first lap of this trip around the world is described in ex. 2.

4. In 1949 the first non-stop flight around the world was made. The distance from Fort Worth, Texas, back to the same point was 23,452 mi. The time was 94 hr. 1 min. Find the approximate speed to the nearest whole mile per hour. 249 What will you use for the time instead of 94 hr. 1 min.? 94 Why? 94 hr. 1 min. is close to 94 hr.

5. In 1950 the first non-stop flight across the Atlantic Ocean by a jet airplane was made. This plane flew 3300 mi. from England to the United States in 10 hr. 1 min. Find its approximate speed. 330 mi.

6. A flying record was made in 1962 when a jet bomber flew from Los Angeles to New York and back to Los Angeles without landing in 4 hr. 42 min. 51 sec. The distance was 4900 mi. Find the approximate speed to the nearest whole mile per hour. Use 4 hr. 42 min. for the time. 1043

7. A record flight of 214 mi. from New York to Washington took 29 min. 15 sec. Find the approximate speed in miles per hour. 428 What will you use for the time instead of using 29 min. 15 sec.? .5 hr.

Pupils should do these problems independently. All common fractions are to be changed to decimal fractions (making such equivalents should now become routine). Have different pupils explain their solutions to problems.

Present a large magic square which is made up of 9 smaller magic squares.

Magic Squares

11	18	13	74	81	76	29	36	31
16	14	12	79	77	75	34	32	30
15	10	17	78	73	80	33	28	35
56	63	58	38	45	40	20	27	22
61	59	57	43	41	39	25	23	21
60	55	62	42	37	44	24	19	26
47	54	49	2	9	4	65	72	67
52	50	48	7	5	3	70	68	66
51	46	53	6	1	8	69	64	71

1. This large magic square has 9 numbers in each row and each column. How many equal sums should there be? 20 Add all the rows, columns, and diagonals to see that you get the same sum each time. How much is each sum? 369

2. This large magic square contains 9 small squares marked off with red lines. Check each of these small squares to see whether it is a magic square.

Each is a magic square.

3. In the small square in the upper left-hand corner of the large square, the sum of each row and each column is 42; in the small square below it, the sum is 177. Draw a square as shown at the right. Then write in the boxes the sums found for the 9 small squares above. Is this square a magic square? Yes

42	231	96
177	123	69
150	15	204

Discuss each example with pupils to be sure they understand explanations and directions. Then have pupils complete the activities. Some pupils may want to make up similar squares for arithmetic corner.

Give simple introduction to addition and subtraction in two units (pages 258–259)

Measuring in Two Units

1. You have learned that you can change 3 ft. 8 in. to inches. 3 ft. = 36 in. 36 in. + 8 in. = 44 in. This shows that 3 ft. 8 in. = 44 in.

2. You can also change 53 in. to feet and inches by dividing 53 by 12. 53 in. = 4 ft. 5 in.

3. It is often desirable to express a measurement in two units. Here are some examples: 8 ft. 3 in.; 6 hr. 13 min.; 4 lb. 10 oz.; 2 gal. 3 qt.

4. You need to know the tables of measure in order to work with measurements in two units. Study the tables on page 305 if you do not know them. Review tables with pupils.

Tell the number that goes in each space:

5. 3 lb. 4 oz. = $\overset{52}{\ldots}$ oz. 50 oz. = $\overset{3}{\ldots}$ lb. $\overset{2}{\ldots}$ oz.

6. 3 da. 19 hr. = $\overset{91}{\ldots}$ hr. 59 hr. = $\overset{2}{\ldots}$ da. $\overset{11}{\ldots}$ hr.

7. 9 ft. 3 in. = $\overset{111}{\ldots}$ in. 63 in. = $\overset{5}{\ldots}$ ft. $\overset{3}{\ldots}$ in.

8. 4 qt. 1 pt. = $\overset{9}{\ldots}$ pt. 17 pt. = $\overset{8}{\ldots}$ qt. $\overset{1}{\ldots}$ pt.

9. 4 hr. 7 min. = $\overset{247}{\ldots}$ min. 95 min. = $\overset{1}{\ldots}$ hr. $\overset{35}{\ldots}$ min.

10. **Problem** At the end of each week Jim is paid for the time he works in a store. This week he worked these times on different days: 1 hr. 20 min.; 30 min.; 1 hr. 30 min.; 3 hr. 15 min. Find the total time Jim worked this week. 6 hr. 35 min.

Explanation Add the minutes and then the hours; the sum is 5 hr. 95 min. But 95 min. can be changed to 1 hr. 35 min. So 5 hr. 95 min. can be changed to 6 hr. 35 min. Jim worked 6 hr. 35 min. in all this week.

1 hr. 20 min.
30 min.
1 hr. 30 min.
3 hr. 15 min.
5 hr. 95 min. = 6 hr. 35 min.

11. Find the sum of 6 ft. 8 in.; 2 ft. 3 in.; 7 ft. 10 in.; and 1 ft. 9 in. 18 ft. 6 in.

Ex. 1–4 and ex. 10–11 should be discussed with the class. In ex. 10 emphasize that minutes are added to minutes, hours to hours. Also stress that in the answer the minutes are changed to hours, where possible.

Measuring in Two Units

1. Jean ordered three articles by mail. The shipping weight of the dress was 1 lb. 12 oz.; of the blouse, 14 oz.; and of the skirt, 1 lb. 7 oz. Find the total shipping weight. 4 lb. 1 oz.

2. Mrs. Booth bought one chicken weighing 3 lb. 12 oz. and another weighing 4 lb. 9 oz. How much did the two chickens weigh together? 8 lb. 5 oz.

3. Last week Henry helped Mr. Black in his garden. He worked these times on three different days: 2 hr. 40 min.; 3 hr. 25 min.; 2 hr. 15 min. How long did Henry work in all? 8 hr. 20 min.

Add. **Check by going over your work:**

4.	5 ft. 9 in.	2 da. 16 hr.	3 gal. 1 qt.
	8 ft. 7 in.	4 da. 15 hr.	7 gal. 3 qt.
	3 ft. 3 in.	3 da. 18 hr.	8 gal. 2 qt.
	17 ft. 7 in.	11 da. 1 hr.	19 gal. 2 qt.

5. **Problem** Judy has 4 yd. 7 in. of yellow material. If she makes an apron that takes 1 yd. 24 in., how much material will she have left? 2 yd. 19 in.

Explanation You cannot subtract 24 in. from 7 in., so change 4 yd. 7 in. to 3 yd. 43 in. Then subtract 24 in. from 43 in. and 1 yd. from 3 yd. Judy would have 2 yd. 19 in. left.

4 yd. 7 in. = 3 yd. 43 in.
1 yd. 24 in. = 1 yd. 24 in.
2 yd. 19 in.

6. Bob has a board 8 ft. long. If he cuts off a piece 2 ft. 8 in. long, how long will the piece be that is left? 5 ft. 4 in.

Subtract. **Check by going over your work:**

7.	7 lb. 12 oz.	8 hr. 32 min.	9 ft. 3 in.
	2 lb. 5 oz.	3 hr. 40 min.	2 ft. 10 in.
	5 lb. 7 oz.	4 hr. 52 min.	6 ft. 5 in.
8.	4 da. 11 hr.	7 bu. 1 pk.	8 qt.
	1 da. 20 hr.	2 bu. 3 pk.	2 qt. 1 pt.
	2 da. 15 hr.	4 bu. 2 pk.	5 qt. 1 pt.

More Practice. See (51) on page 326.

Have pupils do ex. 1-4 independently. Check to see that all pupils understand and have mastered skill. Then discuss ex. 5-6 with them. Have pupils tell "why" and "how" 4 yd. 7 in. must be changed to 3 yd. 43 in.

Present practical application of pages 258-259. When discussing ex. 1, pupils should realize that there is no such thing as the average boy or girl: see G-97.

How Far Can You Jump?

1. The table below tells you that an average boy of 12 is able to jump 5 ft. in the standing broad jump, to run 50 yd. in $8\frac{1}{5}$ sec., and to throw a ball 46 ft. The numbers in the table are called "age standards" for each event.

AGE	A STANDING BROAD JUMP		B RUNNING BROAD JUMP		C 50-YARD DASH		D BALL THROW FREE STYLE	
	BOYS	GIRLS	BOYS	GIRLS	BOYS	GIRLS	BOYS	GIRLS
11	4′ 10″	4′ 2″	8′ 3″	6′ 6″	$8\frac{3}{5}$ sec.	$9\frac{1}{5}$ sec.	38′	30′
12	5′ 0″	4′ 4″	9′ 3″	7′ 0″	$8\frac{1}{5}$ sec.	9 sec.	46′	32′
13	5′ 2″	4′ 6″	10′ 0″	7′ 2″	8 sec.	$8\frac{4}{5}$ sec.	54′	32′
14	5′ 6″	4′ 8″	10′ 6″	7′ 6″	$7\frac{4}{5}$ sec.	$8\frac{3}{5}$ sec.	60′	38′

2. What are the standards for a girl of 12 in each event? A, 4 ft. 4 in.; B, 7 ft.; C, 9 sec.; D, 32 ft. In each event do boys of 12 do better or worse than girls of 12? Better

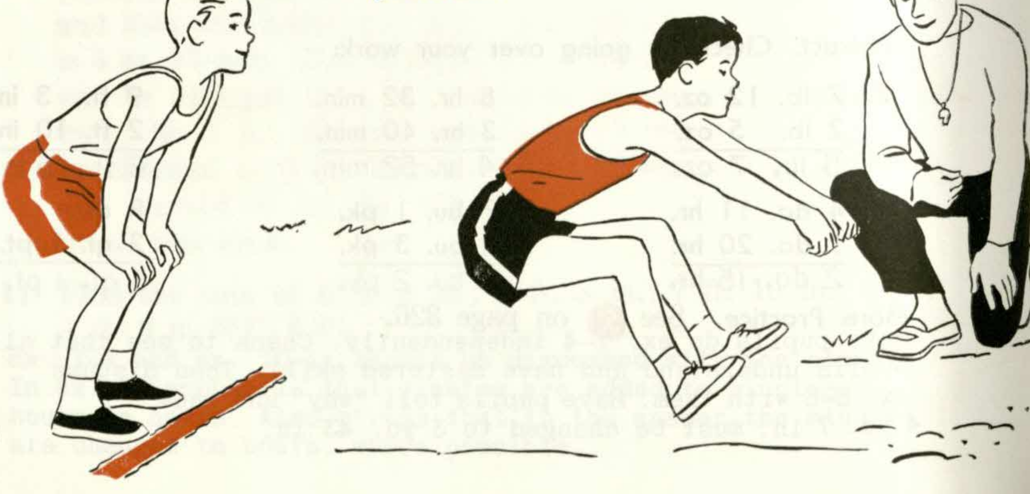
3. Look in the table at the standards for age 13 for the standing broad jump. How much farther does an average boy of 13 jump than an average girl of 13? 8 in.

4. For age 14 how much better do boys do than girls in the running broad jump? 3 ft. in the 50-yard dash? $\frac{4}{5}$ sec. in the ball throw? 22 ft.

▶ Use the table to answer these questions.

5. Judy is 13 yr. old. She can throw a ball 43 ft. How much better is Judy's record than the standard for her age? 11 ft.

Discuss the table with pupils and be sure that all understand how to read it and that they can use it to solve problems.



6. For age 13 how many seconds longer does it take a girl than a boy to run 50 yd.? $\frac{4}{5}$

7. At which age is there the least difference in time for boys and girls in the 50-yard dash? Age 11

8. Ellen is 11 yr. old. Yesterday in the running broad jump she jumped 7 ft. 2 in. How much farther did Ellen jump than the standard for her age in the table? 8 in.

9. How much farther does an average boy of each age jump in a running broad jump than an average girl of the same age? Age 11, 1 ft. 9 in.; age 12, 2 ft. 3 in.; age 13, 2 ft. 10 in.; age 14, 3 ft.

10. Bob is 12 yr. old. He threw a ball 41 ft. 9 in. How close did he come to the standard for his age? 4 ft. 3 in. less than the standard

11. Peter, who is 14, ran 50 yd. in $8\frac{1}{10}$ sec. How much more time was that than the 14-year-old standard? $\frac{3}{10}$ sec.

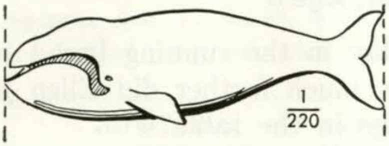
12. Tom, who is 11, jumped 9 ft. 1 in. in the running broad jump. Frank, who is 14, jumped only 8 ft. 8 in. in the running broad jump. How much farther did Tom jump than Frank? 5 in. Is each boy up to the standard for his age? Tom is above standard, Frank is below.

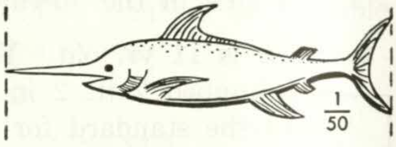
13. Find how far you can jump and throw a ball and how long it takes you to run 50 yd. Then look in the table and compare your records with the standards for your age.

Show another type of scale drawing and give practice in interpreting it.

Drawing to Scale

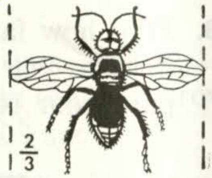
1. In a large dictionary Fred found these pictures:





Under the whale the fraction $\frac{1}{220}$ tells the scale to which the picture is drawn. It means that the length of the picture is $\frac{1}{220}$ of the length of a whale. So the whale is 220 times as long as the picture. Measure between the dotted lines to find the length in inches of the picture of the whale. Then multiply this length by 220 and change the inches to feet and inches. How long is a whale of the kind in the picture? 36 ft. 8 in.

2. The picture of the swordfish is the same length as the picture of the whale, but the fraction under the swordfish is $\frac{1}{50}$. The length of a swordfish is how many times as long as the picture? 50 How long is a swordfish? 8 ft. 4 in.



3. In the picture of the hornet the fraction $\frac{2}{3}$ means that any measurement in the picture is $\frac{2}{3}$ as long as it would be on a real hornet. In the picture you find that the wingspread, measuring between the dotted lines, is 1 in., so 1 in. is $\frac{2}{3}$ of the wingspread of a real hornet. You find the wingspread of a real hornet like this:

$\frac{2}{3}$ of the wingspread = 1 in.
$\frac{1}{3}$ of the wingspread = $\frac{1}{2}$ in.
$\frac{3}{3}$ of the wingspread = $\frac{3}{2}$ in., or $1\frac{1}{2}$ in.

So the real hornet has a wingspread of $1\frac{1}{2}$ in.

4. The picture of a butterfly, drawn to a scale of $\frac{2}{3}$, has a wingspread of 2 in. Find the wingspread of the real butterfly. 3 in.

5. The picture of a hornworm, drawn to a scale of $\frac{3}{4}$, has a length of 3 in. Find the length of the real hornworm. 4 in.

6. In a dictionary find some pictures that show a scale.

Do ex. 1 with class. Then have pupils do ex. 2 independently. Ex. 3 should also be explained before pupils complete ex. 4–5. For ex. 6, have pupils use unabridged dictionary and find length of various insects or animals.

Present last set of improvement tests in addition.
Review basic skills in common fractions.

Improving by Practice

Addition Test 5a. Time: 5 min.

1.	284	243	323	610	589	350
	379	639	187	505	917	219
	406	243	680	964	750	482
	192	152	276	355	417	578
	380	268	448	473	350	947
	255	431	775	754	646	490
	184	718	632	212	399	288 ⑥
	2080	2694	3321	3873	4068	3354

Addition Test 5b. Time: 5 min.

2.	974	467	923	312	204	966
	516	553	236	888	310	341
	369	462	585	511	797	829
	454	927	356	497	271	196
	776	483	768	829	686	976
	625	168	803	139	758	655
	418	958	329	407	425	247 ⑥
	4132	4018	4000	3583	3451	4210

Addition Test 5c. Time: 5 min.

3.	431	723	615	983	715	479
	654	210	258	240	351	804
	395	387	112	685	406	360
	126	927	645	994	316	307
	359	556	383	426	495	182
	730	874	787	643	457	687
	248	419	987	185	268	401 ⑥
	2943	4096	3787	4156	3008	3220

To the Pupil. This is the last set of Improvement Tests in addition you will have this year. Try to get a score of 10 on each test.

Mixed Practice

Find the answers. Watch the signs: Stress.

4. $\frac{3}{8} + \frac{3}{4}$ $1\frac{1}{8}$ $6 \times \frac{5}{8}$ $3\frac{3}{4}$ $\frac{9}{10} - \frac{1}{2}$ $\frac{2}{5}$ $2\frac{1}{4} \times 1\frac{1}{6}$ $2\frac{5}{8}$ $4\frac{1}{6} \div \frac{5}{12}$ 10

5. $\frac{5}{6} - \frac{1}{2}$ $\frac{1}{3}$ $\frac{3}{5} + \frac{1}{2}$ $1\frac{1}{10}$ $\frac{15}{16} \div \frac{3}{4}$ $1\frac{1}{4}$ $3\frac{1}{6} + 2\frac{3}{4}$ $5\frac{11}{12}$ $7\frac{1}{2} \times 1\frac{1}{2}$ $11\frac{1}{4}$

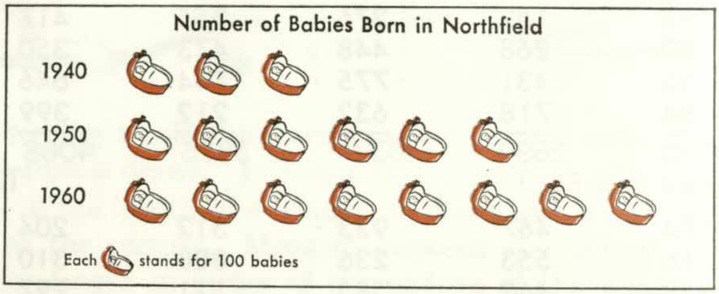
6. $\frac{5}{8} \div \frac{1}{2}$ $1\frac{1}{4}$ $\frac{1}{3} + \frac{1}{6}$ $\frac{1}{2}$ $12 \times \frac{3}{8}$ $4\frac{1}{2}$ $3\frac{3}{8} \div 1\frac{1}{2}$ $2\frac{1}{4}$ $4\frac{1}{8} - 3\frac{3}{4}$ $\frac{3}{8}$

Urge pupils to work quickly but "carefully" in completing addition tests. Since this is last addition set, note improvements and/or weaknesses on progress cards. See also pages 54-58, 107, 167, 213 for other suggestions.

Teach the reading and making of picture graphs (pages 264-265).

Picture Graphs

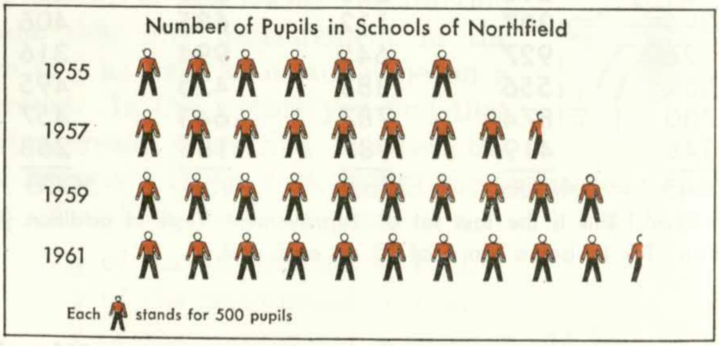
1. Frank brought home from school a printed report showing why more teachers and school buildings are needed in Northfield. This **picture graph** was in the report:



How many babies were born in 1940? Each picture of a baby stands for 100 babies. Since there are 3 babies in the line marked 1940, there were 3 × 100 babies, or 300 babies, born in 1940.

Tell the number of babies born in each of the other years. 1950 : 600; 1960: 800

2. Frank also found this picture graph in the report:



Study the picture graph and tell the number of pupils in each of the four years.(1) In 1957 and 1961 how many pupils does half of a child stand for? (2) (1) 1955: 3500; 1957: 4250; 1959: 5000; 1961: 5250; (2) 250

3. Why does Northfield need more teachers and school buildings?

4. Bring to class some picture graphs you have found in newspapers and magazines. Be sure pupils can interpret them. Post on bulletin board for further reference.

Pupils will probably not have too much difficulty in reading picture graphs. Do ex. 1-3 as class activity. Discuss and contrast other graphs (bar and line) known to pupils, with new type.

Making Graphs

1. The airlines used these numbers of airplanes for passenger flights in the United States in these years: 1945, 400 airplanes; 1950, 1000 airplanes; 1954, 1200 airplanes; 1961, 1900 airplanes. Show this with a picture graph. See G-98 Use a small drawing of an airplane to stand for 200 airplanes. Put a title above the graph and below it tell how many airplanes each drawing of an airplane stands for. Have pupils construct graph under your direction. Be sure all draw it correctly.

Stress. →

2. Make a picture graph to show that three large companies made these numbers of automobiles last week: 30,000 cars, 45,000 cars, 80,000 cars. Make up a name for each company and use a drawing of a car to stand for 10,000 cars. See G-99.

3. Draw a bar graph to show the number of papers each of these boys sold last week: Bill, 350; Sam, 300; Henry, 275; George, 250. Decide what scale you will use before you begin to draw the graph. Graphs will vary, depending on scale used.

4. Draw a line graph showing these changes in temperature during part of a day: See G-99.

Hour	7	8	9	10	11	12	1	2	3	4
Degrees	64	64	66	71	74	78	79	80	78	72

Answer these questions by looking at your graph:

(a) At what hour was the temperature the highest? 2 P.M.
(b) Between what hours did it rise the most? 9 A.M. and 10 A.M.
(c) Between what hours did it drop the most? 3 P.M. and 4 P.M.
(d) Between what hours did it remain the same? 7 A.M. and 8 A.M.

5. Draw a line graph showing the changes in the prices of eggs that Bob sold during these months: See G-100.

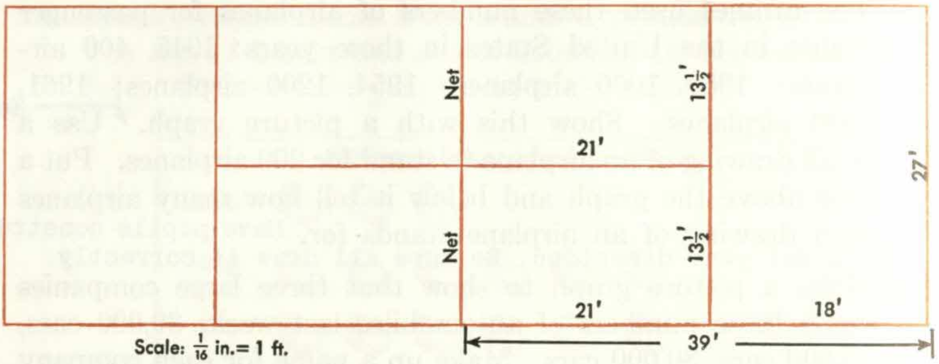
Month	Jan.	Feb.	Mar.	Apr.	May	June	July
Price	68¢	65¢	60¢	52¢	48¢	50¢	55¢

6. Draw a line graph to show these changes in Judy's weight for these 6 yr.: 1957, 61 lb.; 1958, 64 lb.; 1959, 67 lb.; 1960, 69 lb.; 1961, 72 lb.; 1962, 75 lb. See G-100.

Note that in ex. 4-5 pupils must read tables in order to build graphs. Point out the three ways of presenting data: paragraph form (ex. 2); tables (ex. 4-5); graphs.

Extend teaching of scale drawings. After completing ex. 1-3, have pupils use geography or social-studies books to determine scales used for different maps.

Drawing a Tennis Court

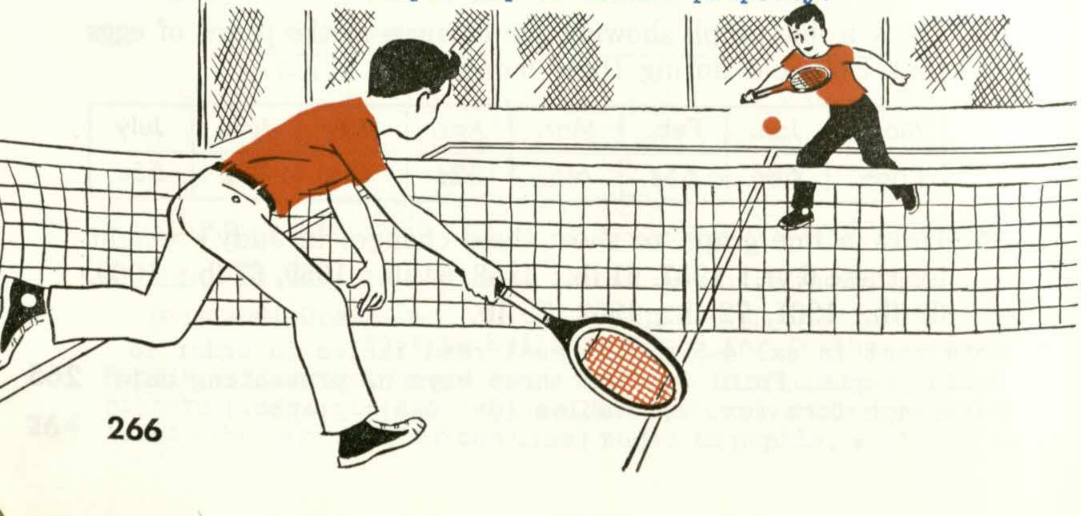


1. This is a scale drawing of a tennis court. It has been drawn to a scale of $\frac{1}{16}$ in. = 1 ft. The length of each line in feet is shown on the drawing. How many feet long is the entire tennis court? 78 How many inches should stand for the length of the court? $4\frac{7}{8}$ Use your ruler to see whether the drawing is that length. How many inches should stand for the width of the court? $1\frac{11}{16}$

2. On a sheet of paper draw a tennis court to scale, letting $\frac{1}{8}$ in. = 1 ft. The court is 78′ long. How many inches stand for 78′? $9\frac{3}{4}$ It is 27′ wide. How many inches stand for 27′? $3\frac{3}{8}$ How many inches stand for 21′? $2\frac{5}{8}$ 18′? $2\frac{1}{4}$ $13\frac{1}{2}'$? $1\frac{11}{16}$

3. On the blackboard draw the tennis court again, using a scale of $\frac{1}{4}$ in. = 1 ft. How many inches stand for 78′ now? $19\frac{1}{2}$ How many inches stand for 27′? $6\frac{3}{4}$ 21′? $5\frac{1}{4}$ 18′? $4\frac{1}{2}$ $13\frac{1}{2}'$? $3\frac{3}{8}$ How does this drawing compare with the one you made in ex. 2?

Have pupils make simple map of school property.



Review problem solving in which
common and decimal fractions occur.

Review Problems

1. Frank has saved \$24.10 since Christmas. This is \$8.75 more than Peter has saved in the same time. How much has Peter saved? \$15.35

2. If soap sells at 3 bars for \$.25, how much does 1 doz. bars of soap cost? \$1.00

3. What part of a ton is 500 lb.? $\frac{1}{4}$ 1200 lb.? $\frac{3}{5}$

4. If $\frac{1}{4}$ in. stands for 5 mi. on a scale drawing, how many miles are shown on the drawing by a line $2\frac{1}{2}$ in. long? 50

5. Last year Mr. Clark spent \$162.70 for gasoline for his car. He bought 583 gal. in all. Find, to the nearest cent, the average price he paid per gallon of gasoline. About \$.28

6. At the last club meeting there were 24 boys present. This was only $\frac{3}{4}$ of the boys who belong to the club. How many boys belong to the club? 32

7. Jim read in the newspaper that a jet fighter made 4 test runs on the same course at these speeds: 811 mi. an hour, 806 mi. an hour, 808 mi. an hour, and 802 mi. an hour. Find the average of these speeds. $806\frac{3}{4}$ mi.

8. Jim also read that another jet airplane made 4 test runs on a longer course at these speeds: 699 mi. an hour, 709 mi. an hour, 698 mi. an hour, and 707 mi. an hour. Find the average of the speeds of this plane. $703\frac{1}{4}$ mi.

9. If an airplane has a speed of 606 mi. an hour, find, to tenths of a mile, its speed in miles per minute. 10.1

10. Tom was at baseball practice $1\frac{1}{4}$ hr. on Monday, $1\frac{2}{3}$ hr. on Wednesday, $1\frac{3}{4}$ hr. on Thursday, and $1\frac{1}{2}$ hr. on Friday. How many hours in all was Tom at baseball practice? $6\frac{1}{6}$

11. Find the volume of a rectangular box that is $1\frac{1}{2}$ ft. wide, $2\frac{3}{4}$ ft. long, and 8 in. deep. $2\frac{3}{4}$ cu. ft.

After checking papers have volunteers explain their solutions. Group those who had errors to determine causes (lack of understanding of problem situations, processes, skills, carelessness).

See G-101 for correlation of examples with aims.

Chapter Review

1. Jerry is planning to make a scale drawing of his garden which is 16 ft. by 22 ft. Jerry's scale will be $\frac{1}{4}$ in. = 1 ft. Make a scale drawing of Jerry's garden, using his scale. Scale drawing: 4 in. by $5\frac{1}{2}$ in.

2. Write a receipt to Charles Fox for $15.00. He paid you that amount for your old bicycle.

3. A box is $2\frac{1}{4}$ ft. wide, $4\frac{1}{4}$ ft. long, and 2 ft. deep. How many cubic feet does the box contain? $19\frac{1}{8}$

4. Martha saw a picture of a yellow perch in the dictionary with $\frac{1}{8}$ printed under it. She measured the length of the picture of the yellow perch and found it to be $1\frac{1}{4}$ in. How long is a real yellow perch? 10 in.

5. How many cubic inches are there in 2 cu. ft.? 3456 in $3\frac{1}{2}$ cu. ft.? 6048 in $2\frac{1}{4}$ cu. ft.? 3888

6. How many cubic yards are there in 81 cu. ft.? 3 in 108 cu. ft.? 4 in 135 cu. ft.? 5

7. Write a bill to Mrs. Frank Martin for 3 pr. stockings @ \$.98; \$2.94 6 handkerchiefs @ \$.49; \$2.94 7 yd. ribbon @ \$.23. \$1.61; total, \$7.49

8. George bought a glass tank 22 in. long and 14 in. wide. He will have the water in the tank 9 in. deep. (2772 cu. in.) How many gallons of water will he need? 12 1 gal. = 231 cu. in.

Add. Check by going over the work:

9.

4 hr. 22 min.	15 ft. 8 in.	5 lb. 14 oz.
2 hr. 18 min.	12 ft. 7 in.	2 lb. 12 oz.
6 hr. 45 min.	17 ft. 9 in.	7 lb. 9 oz.
13 hr. 25 min.	46 ft.	16 lb. 3 oz.

Subtract. Check by going over the work:

10.

5 min. 10 sec.	9 yd.	7 ft. 3 in.
1 min. 25 sec.	4 yd. 9 in.	2 ft. 7 in.
3 min. 45 sec.	4 yd. 27 in.	4 ft. 8 in.

11.

8 gal.	6 bu. 2 pk.	9 lb. 4 oz.
2 gal. 3 qt.	2 bu. 1 pk.	2 lb. 7 oz.
5 gal. 1 qt.	4 bu. 1 pk.	6 lb. 13 oz.

Use review as preparation for diagnostic test and reteach or review further, based on results. Pupils who did well might like to work on large magic squares, while you work with others.

A Problem Test

1. Mr. Martin finds that he can drive his car about 16 mi. on 1 gal. of gasoline. If he has 15 gal. in the tank, about how many miles can he drive on that amount? 240

2. Find the cost of 1 yd. of ribbon if $\frac{3}{4}$ yd. costs 45¢. 60¢

3. A 2-ounce bar of candy costs 10¢. How much will 1 lb. of these bars cost? 80¢

4. The rainfall in Northfield for each month last year was as follows: 7.76 in., 3.92 in., 3.83 in., 2.68 in., .45 in., 3.88 in., 3.18 in., 2.90 in., 1.43 in., 1.68 in., .92 in., 4.33 in. Find the average monthly rainfall. 3.08 in.

5. An airplane made a trip of 1070 mi. in 3 hr. 30 min. Find its speed in miles per hour to the nearest whole mile. 306

6. If you run around a block that measures 200 ft. by 240 ft., (perimeter = 880 ft.) what part of a mile do you run? $\frac{1}{6}$

7. At the Star Store a large radio costs $375. A small radio costs $25. How many times as much as the small radio does the large radio cost? 15

8. A swimming pool is 60 ft. long and 30 ft. wide. How many cubic feet of water will be needed when the water is, on the average, 6 ft. deep? 10,800

9. Mrs. Ball had $.83 left when she came home from the store. She had spent $2.79 for meat and $2.35 for groceries. How much money did she have before she went to the store? $5.97

10. Henry earns $1.35 a week and spends $.55 a week. How many weeks will it take him to save $24? 30

How many problems did you get right? Look below to find out what your score means. Remind pupils to record scores.

SCORE	0–5 You need help	6–7 Fair	8–9 Good	10 Excellent

Instruct pupils to read problems carefully (see page 212). Through conferences with pupils who did poorly, try to determine if they are using all problem aids they know, if they are using correct processes, if they are computing correctly, and so on.

Present diagnostic test on areas, volumes, and measures, with practice-page references.

How Much Have You Learned?

If you miss more than one example in a row, turn to the Practice Page for that row.

Practice Pages

Find the areas of rectangles with these dimensions:

1. 32 ft. × 75 ft. 2400 sq.ft. 4 ft. × 8 ft. 6 in. 34 sq.ft. 112

2. 25 yd. × 42 yd. 1050 sq.yd. 6 ft. × 7 ft. 8 in. 46 sq.ft. 112

Find the volumes of boxes with these dimensions:

3. 3″ × 5″ × 8″ 120 cu.in. 4″ × 8″ × $2\frac{1}{2}$″ 80 cu.in. 246

4. 4′ × 8′ × 18″ 48 cu.ft. 6″ × 4′ × 3′ 6 cu.ft. 247

Tell what number to put in each space:

5. 3 sq. ft. = 432 . . sq. in. 36 sq. in. = $\frac{1}{4}$ . . sq. ft. 115

6. 4 sq. yd. = 36 . . sq. ft. 6 sq. ft. = $\frac{2}{3}$ . . sq. yd. 115

7. 2 cu. yd. = 54 . . cu. ft. 9 cu. ft. = $\frac{1}{3}$ . . cu. yd. 248

8. 3 cu. ft. = 5184 . . cu. in. 81 cu. ft. = 3 . . cu. yd. 248

9. Find the cost of a rug 9 ft. wide and 12 ft. long at $4.50 a square yard. $54.00 (12 sq.yd.) 113

10. Peter has a rectangular can of oil measuring 6″ × 7″ × 11″. (462 cu. in.) How many gallons of oil will it hold? 2 231 cu. in. = 1 gal. 249

Add. Check by going over the work:

11. 259

6 lb. 5 oz.	7 yd. 1 ft.	8 ft. 6 in.
3 lb. 14 oz.	6 yd. 2 ft.	3 ft. 9 in.
7 lb. 3 oz.	4 yd. 2 ft.	2 ft. 5 in.
17 lb. 6 oz.	18 yd. 2 ft.	14 ft. 8 in.

Subtract. Check by going over the work:

12. 259

7 hr. 31 min.	7 qt.	4 bu.
2 hr. 55 min.	4 qt. 1 pt.	2 bu. 2 pk.
4 hr. 36 min.	2 qt. 1 pt.	1 bu. 2 pk.

After checking papers and noting kinds of errors on progress cards, return papers to pupils so they may find and correct mistakes. Assign remedial work after difficulties are cleared up.

Main purpose of Chapter 8 is to consolidate learnings acquired in Grade 6. See G-103 for specific aims and list of pages for end-of-year testing suggestions.

Chapter 8

The Twenty-Four-Hour Clock

Develop understanding of 24-hour clock; see G-103.

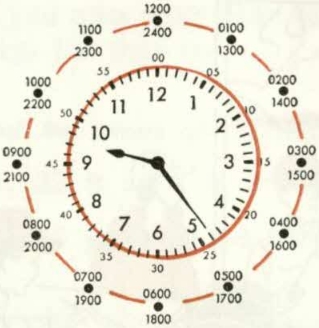
1. There are two systems for giving the time of day. The ordinary system of telling time, which you already know, uses the 12-hour clock. When you write 7:45 A.M., the letters A.M. indicate time before noon. The letters P.M. indicate time after noon. Write quarter past 3 in the afternoon. 3:15 P.M.

2. The other system of telling time uses the 24-hour clock. When the 24-hour clock is used, time is given in hours and Emphasize: minutes after midnight. The time is always written with four figures. The first two figures give the number of hours after midnight and the last two figures give the number of minutes. Therefore 3 hours after midnight is written 0300, 8 hours 15 minutes after midnight is written 0815, and 14 hours after midnight is written 1400. How would you write 18 hours after midnight? 1800 7 hours 30 minutes after midnight? 0730 13 hours 6 minutes after midnight? 1306

3. In the United States the 24-hour clock is the official system of giving time in the Army, Navy, and Air Force. In Europe this system is also used in timetables for trains and airplanes. Write 3:28 P.M. by the 24-hour system. 1528

Discuss ex. 1-3 with pupils. In ex. 2 have them also write the times using 12-hour system. To enrich discussion of 24-hour system, urge pupils (who had relatives in service) to bring in records based on this system.

The Twenty-Four-Hour Clock



1. The drawing on the left shows the relationship between the time of day using the 12-hour clock and the time of day using the 24-hour clock. The upper numbers in the outer circle tell the time in hours for the 24-hour clock from midnight to noon, and the lower numbers on this circle tell the time from noon to midnight. You can see that 8:00 A.M. is the same as 0800; that 4 P.M. is the same as 1600.

2. The minute hand gives the number of minutes for both kinds of clocks. So 9:24 A.M. is the same as 0924, and 2:19 P.M. is the same as 1419.

3. On the 24-hour clock the end of the day is 2400 and the beginning of a new day is 0000. How would you write noon, using the 24-hour clock? 1200

4. Change the following times from the 12-hour system to the 24-hour system: 4:20 A.M.; 0420 6:30 P.M.; 1830 10:00 A.M.; 1000 5:50 P.M.; 1750 11:05 A.M.; 1105 3:15 A.M.; 0315 11:00 P.M.; 2300 12:45 A.M. 0045

5. Change the following times from the 24-hour system to the 12-hour system: 0749; 7:49 A.M. 1915; 7:15 P.M. 0903; 9:03 A.M. 0026; 12:26 A.M. 1700; 5 P.M. 2230; 10:30 P.M. 1000; 10:00 A.M. 1955. 7:55 P.M.

6. How many hours and minutes is it from 8:45 A.M. to 9:15 P.M. on the same day? 12 hr. 30 min.

7. How many hours and minutes is it from 0209 to 1435 on the same day? 12 hr. 26 min. from 0450 to 1725? 12 hr. 35 min.

8. How many hours and minutes is it from 1935 on Monday to 0815 on Tuesday? 12 hr. 40 min. from 1015 on Thursday to 1530 on Saturday? 53 hr. 15 min.

9. An Air Force pilot is ordered to leave on a flight at 2255. What time is that on the 12-hour clock? 10:55 P.M.

Ex. 1–3 should be discussed thoroughly with pupils. Then have them complete ex. 4–9 independently. Encourage pupils who are familiar with the Navy system of bells to explain meaning of 6 bells, and so on.

Teach meaning of per cent and language peculiar to percentage (pages 273–275).

Meaning of Per Cent

Prices of
ALL BICYCLES
Reduced 20%

1. At the right is a notice that Ted saw in a store window. The sign **%** is read **per cent** and means **hundredths.** So "20%" on this notice is read "20 per cent" and means $\frac{20}{100}$.

Stress meaning

You have learned to write the fraction $\frac{57}{100}$ as .57, which is a decimal. Another way to write $\frac{57}{100}$ is 57%, which is read 57 per cent. Show these on a hundred board also.

$\frac{57}{100}$ = .57 = 57% = 57 per cent

$\frac{3}{100}$ = .03 = 3% = 3 per cent

When working problems which use per cents, you often need to change per cents to decimals or to change decimals to per cents.

2. Per cents are used in business, science, and industry. You will see them in newspapers and magazines. You cannot understand statements that use the words "per cent" or the sign "%" if you are not familiar with the meaning of per cent.

Write these as per cents:

3. $\frac{29}{100}$ 29% $\frac{32}{100}$ 32% $\frac{60}{100}$ 60% $\frac{41}{100}$ 41% $\frac{85}{100}$ 85% $\frac{2}{100}$ 2% $\frac{11}{100}$ 11%

4. .14 14% .75 75% .22 22% .61 61% .01 1% .48 48% .06 6%

Write these as decimals:

5. 23% .23 95% .95 39% .39 1% .01 40% .40 9% .09 72% .72

Read these statements:

6. Automobile production has increased 10% this year.

7. The school nurse says that 23% of the pupils at the Hart School wear glasses.

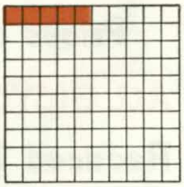
8. Prices of all tennis rackets have been reduced 15%.

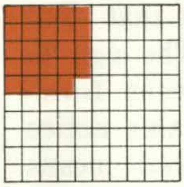
9. Farmers seek 4% increase in the price of milk.

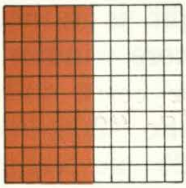
10. Helen saved 25% on the cost of a dress by buying it at a sale.

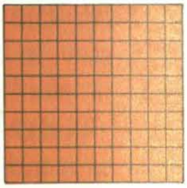
Have pupils bring in examples of uses of per cents, as found in newspapers, magazines, and business reports.

Meaning of Per Cent


A


B


C


D

1. Each large square above is divided into 100 small squares. One small square is $\frac{1}{100}$ of the large square. What per cent of each large square is each small square? 1%

2. In square A, 5 small squares are red. What per cent of square A is red? 5% How many small squares in A are white? 95 How can you find the number of white squares without counting them? What per cent of A is white? 95%
Subtract 5 from 100

3. Look at squares B and C and tell what per cent of each is red and what per cent of each is white.
B: red, 24%; white, 76%. C: red, 50%; white, 50%

4. In square D, you see that **all** the small squares, or 100 small squares, are red. This means that $\frac{100}{100}$ or 100% of square D is red. You see that 100% of square D means **all** of square D. Stress.

5. Draw 3 large squares like squares A, B, and C above. Divide each of your squares into 100 small squares; to do this, mark off 10 equal spaces on each side of the large square. By drawing lines you will then have 100 small squares in each large square. Shade 25% of the first square,(1) 32% of the second square,(2) and 50% of the third square.(3) What per cent of each square is not shaded? (1) 75%; (2) 68%; (3) 50%

6. Make 2 more squares like those in ex. 5. Shade all but 15% of the first square(1) and all but 25% of the second square.(2) What per cent of each square is shaded? (1) 85%; (2) 75%

7. Draw some squares and divide each into 100 small squares. Draw designs in each square by coloring some of the small squares; then tell what per cent of each square is colored and what per cent is white.

Discuss ex. 1-4 with pupils, emphasizing meaning of per cent as "so many out of a hundred." Supply pupils with graph paper to use for ex. 5-7. Give further work in showing various per cents on diagrams.

Review meaning of "of" after a fraction. Lead pupils to see that it applies to per cents also, since they are another way of writing common or decimal fractions.

Finding a Per Cent of a Number

1. **Problem** · The pupils and parents of the South School had a fair to earn money for buying school equipment. The amount earned was $526. It was decided to spend 35% of this money for playground equipment. How much can be spent for it?

Explanation You need to find 35% of $526. This means $\frac{35}{100}$ of $526. You know that $\frac{35}{100}$ of $526 = $\frac{35}{100}$ × $526. Why? Another way to write $\frac{35}{100}$ × $526 is .35 × $526. Multiplying $526 by .35 you get $184.10. So $184.10 can be spent for playground equipment. Check the work by going over it.

$$\begin{array}{r} \$526 \\ .35 \\ \hline 26\,30 \\ 157\,8 \\ \hline \$184.10 \end{array}$$

Stress.

To find a per cent of a number, change the per cent to a decimal and multiply.

2. It was decided to spend 20% of the money earned at the South School fair (see ex. 1) for new books for the school library. How much of the money can be spent in this way? $105.20

3. Dick read in the school paper that the baseball team played 20 games and won 65% of them. How many games did the team win? 13 ▶ .65 × 20 = 13.00 So 65% of 20 is 13.

Give the number that goes in each space:

4. 42% of 150 = .42 × 150 = 63

5. 60% of 480 = .60 × 480 = 288

6. 4% of 300 = .04 × 300 = 12.

Find the answers:

7. 45% of 60 27 7% of 400 28 1% of 500 5 39% of $200 $78.00

8. 12% of 50 6 3% of 800 24 4% of 150 6 25% of $230 $57.50

9. 20% of 70 14 1% of 600 6 8% of 250 20 11% of $320 $35.20

More Practice. See ㊷ on page 326.

Give more practice in changing per cents to decimal fractions, if needed.

Meaning of 100 Per Cent

1. On page 274, **all** of square D is red. So $\frac{100}{100}$ or 100% of it is red. You see that:

$$\frac{100}{100} = 1 = 100\% = 100 \text{ per cent}$$

2. 100% of 1 pie means $\frac{100}{100}$ of 1 pie, or $\frac{100}{100} \times 1$ pie. Since $\frac{100}{100} \times 1 = 1 \times 1 = 1$, 100% of 1 pie means the **whole** pie.

3. 100% of 675 pupils means $\frac{100}{100} \times 675$ pupils, or 1×675 pupils. Since $1 \times 675 = 675$, you see that 100% of 675 pupils means **all** the 675 pupils.

4. 100% of the boys means **all** the boys.
100% of the tickets means **all** the tickets.
100% of the class means the **whole** class.
100% of the examples correct means **all** examples correct.

5. John read about a truck driver whose "safety record" was 100% for the past ten years. What does this mean?

6. Mrs. Walker bought a coat that was marked "100% wool." Tell the meaning of this.

7. Try to find a statement that contains the expression "100 per cent" or "100%." You may find it in your reading, or in a store, or you may hear it on the radio or television.

Have pupils bring examples to class and explain meaning.

Make these statements using per cents:

8. Every member of the class belongs to a school club.

9. Betty worked every problem correctly.

10. Jack spent all of his savings for a bicycle.

11. This year all the pupils in the fifth, sixth, and seventh grades of the George Washington School have become members of the Junior Red Cross.

12. All the employees of the Smith Company contributed to the Thanksgiving collection.

13. Mr. Hill built a new apartment house. Yesterday he said that all the apartments were rented.

Discuss concepts in ex. 1-4 with pupils, stressing idea that 100% means "all." Have pupils bring to class various examples of use of 100% as given in ex. 8-13.

Present last set of improvement tests in subtraction.

Improving by Practice

Subtraction Test 5a.

Time: 5 min.

1.	684719	617738	315495	182927
	472304	252856	233667	86935
	212,415	364,882	81,828	95,992
2.	638668	607535	800000	734245
	346694	425569	252936	346898
	291,974	181,966	547,064	387,347
3.	200004	934323	152134	408007
	181769	257898	72398	254359 ⑫
	18,235	676,425	79,736	153,648

Subtraction Test 5b.

Time: 5 min.

4.	258868	412265	754082	443844
	115163	114775	283713	245862
	143,705	297,490	470,369	197,982
5.	115575	900000	553127	839617
	34987	484269	186344	785950
	80,588	415,731	366,783	53,667
6.	709002	163523	600008	717277
	344437	68746	251979	147699 ⑫
	364,565	94,777	348,029	569,578

Subtraction Test 5c.

Time: 5 min.

7.	868876	641427	117952	500000
	756324	455795	73257	223696
	112,552	185,632	44,695	276,304
8.	331121	832828	806003	405624
	249279	698938	772529	125968
	81,842	133,890	33,474	279,656
9.	300001	136973	536414	512119
	146712	75996	366986	484330 ⑫
	153,289	60,977	169,428	27,789

To the Pupil. This is the last set of Improvement Tests in subtraction you will have this year. Try to get a score of 10 on each test.

Compare results of these tests with previous ones as noted in pupils' Score Books. Record improvements or further weaknesses on progress cards. Confer with pupils who had errors to determine causes and clear up difficulties.

Present end-of-year test on comprehension of large numbers, in problems about New York City.

Our Largest City

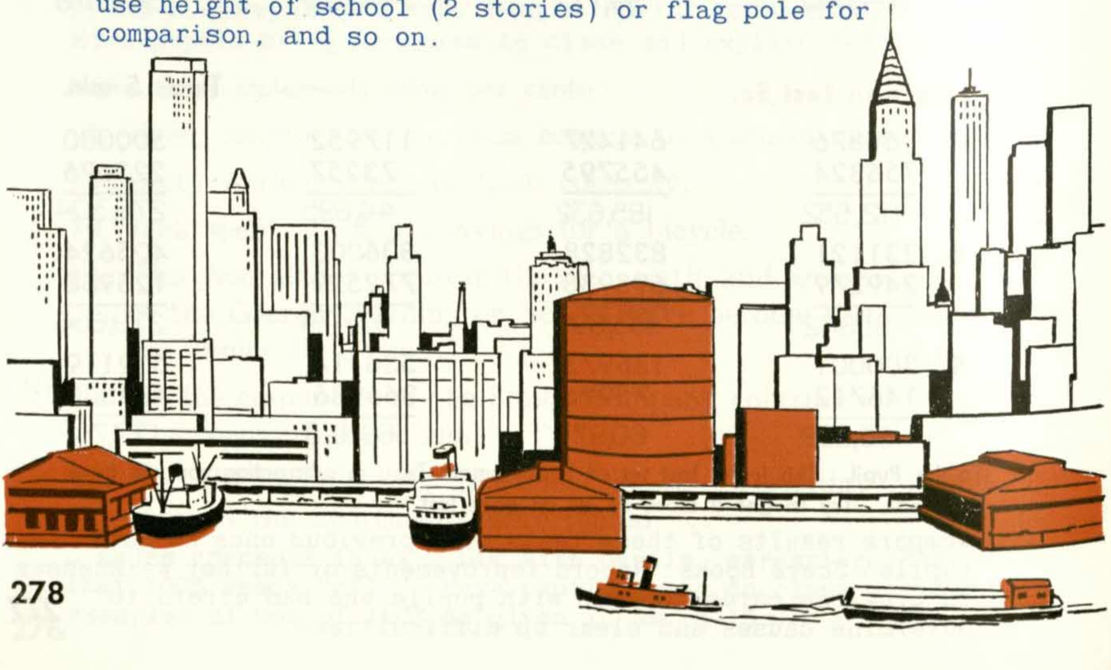
1. New York City is the largest city in the United States. It had a population of 7,781,984 people in 1960. Round off this number to the nearest thousand; 7,782,000 to the nearest ten thousand; 7,780,000 to the nearest hundred thousand; 7,800,000 to the nearest million. 8,000,000 Try to find out what the estimated population of New York City was for last year.

2. New York City has an area of 316 sq. mi. Using the population given in ex. 1, find how many people, on the average, live in a square mile. 24,627

3. The Empire State Building in New York is the tallest building in the world. Its height is 1472 ft. It has 102 stories and a 222-foot television sending tower at the top. What is the height of the 102 stories? 1250 ft. Find the average height of a story, correct to the nearest tenth of a foot. 12.3

4. The transit system owned and operated by New York City is made up of subway, elevated train, and bus routes which have a total mileage of 766 miles. About 70% of this mileage is bus routes. About how many miles of bus routes are there in the New York City transit system? 536.2

Extend comprehension of large numbers by comparisons: ex. 1, compare population with that of your state; ex. 3, use height of school (2 stories) or flag pole for comparison, and so on.



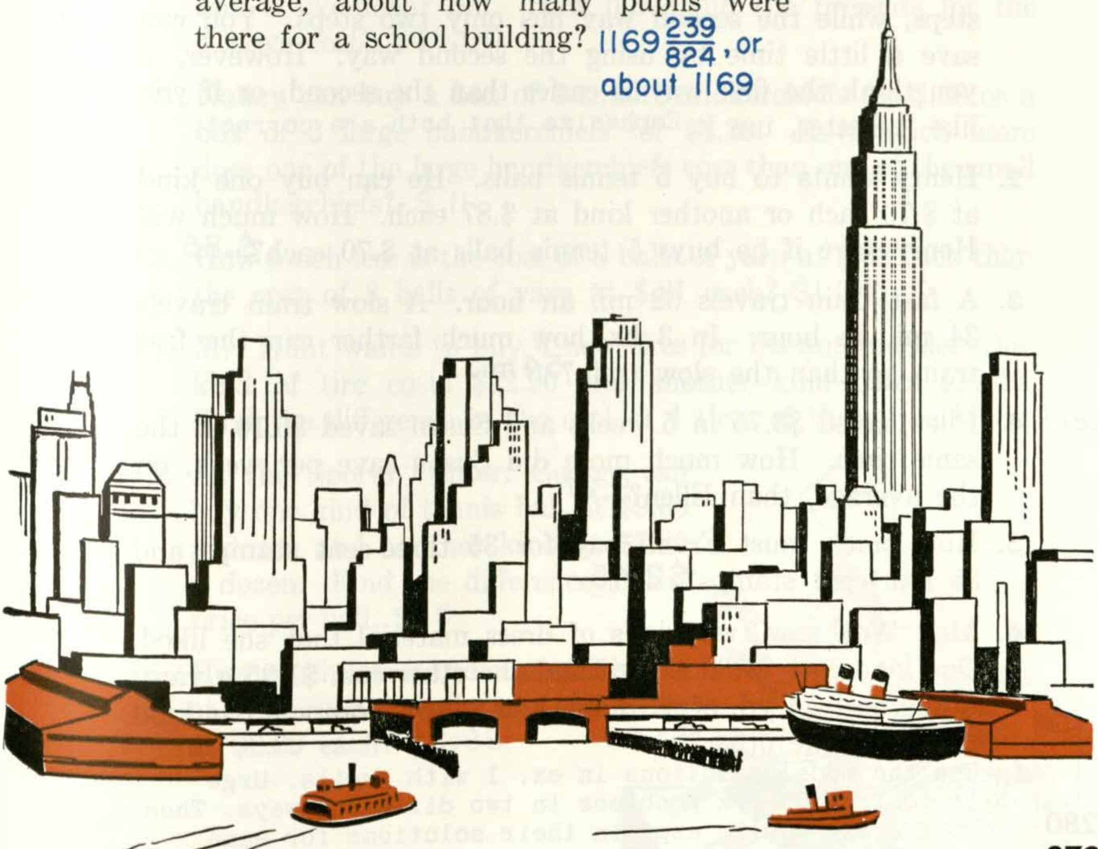
5. During one year the New York City transit system carried a total of 1,795,106,754 passengers. Round off this number to the nearest thousand. 1,795,107,000 Then find the number of passengers carried, on the average, each month. 149,592,250

6. In a recent year there were 4,411,982 telephones in New York City. If an average of 6 calls per telephone were made during one day, what would be the total number of telephone calls made in New York that day? 26,471,892

7. Every $3\frac{1}{3}$ minutes one baby is born in New York City, on the average. About how many babies are born per hour? 18 per day? 432 per year? 157,680

8. Every day 5 sets of twins are born in New York, on the average. How many sets of twins are born in one year? 1825

9. During a recent year 963,495 pupils were enrolled in elementary and high schools in New York City. There were 824 school buildings for these pupils. On the average, about how many pupils were there for a school building? $1169\frac{239}{824}$, or about 1169



Show how certain problems may be solved in two different ways.

Which Way Is Easier?

Some problems can be solved in more than one way. Study the two ways of solving ex. 1.

1. **Problem** Jean can make aprons at a cost of $.57 each for material. She sells these aprons at $.85 each. How much money does Jean make on 6 aprons? $1.68

First way to solve ex. 1

(1) 6 aprons cost 6 × $.57, or $3.42.
(2) 6 aprons sell for 6 × $.85, or $5.10.
(3) On 6 aprons Jean makes $5.10 – $3.42, or $1.68.

Second way to solve ex. 1

(1) On 1 apron Jean makes $.85 – $.57, or $.28.
(2) On 6 aprons Jean makes 6 × $.28, or $1.68.

Which way do you like better? The first way has three steps, while the second way has only two steps. You can save a little time by using the second way. However, if you think the first way is easier than the second, or if you like it better, use it. Emphasize that both are correct.

2. Henry wants to buy 5 tennis balls. He can buy one kind at $.70 each or another kind at $.87 each. How much will Henry save if he buys 5 tennis balls at $.70 each? $.85

3. A fast train travels 52 mi. an hour. A slow train travels 34 mi. an hour. In 3 hr. how much farther can the fast train go than the slow train? 54 mi.

4. Ellen saved $3.75 in 5 weeks and Susan saved $5.10 in the same time. How much more did Susan save per week, on the average, than Ellen? $.27

5. How much must Frank pay for 35 three-cent stamps and 35 four-cent stamps? $2.45

6. Mrs. Wolf saw two kinds of dress material that she liked. One kind cost $1.69 a yard and the other cost $1.95 a yard. If she needs 4 yd. of material, how much more will one kind cost than the other? $1.04

Discuss the model solutions in ex. 1 with pupils. Urge pupils to try to work problems in two different ways. Then have different pupils explain their solutions for same problems.

7. Tickets for the school play sell at $.45 each. Charles sold 49 tickets and Bob sold 37 tickets. How much money in all did both boys get for the tickets they sold? $38.70

8. Mrs. Page bought 8 cans of tomatoes and 5 cans of peaches. Both the tomatoes and the peaches cost 29¢ a can. How much did Mrs. Page pay all together? $3.77

9. John wants to buy 6 quarts of ice cream for the club party. One kind of ice cream costs $.59 a quart and another kind costs $.75 a quart. How much more will John have to pay for 6 quarts of the ice cream that costs $.75 a quart? $.96

10. Peggy can walk at the rate of 3 mi. an hour. When she rides her bicycle she can go 7 mi. an hour. In $\frac{1}{2}$ hr. how much farther can Peggy go by bicycle than by walking? 2 mi.

11. Mr. Grant gave each of his 4 nephews the same present for Christmas. He gave each boy a fountain pen that cost $3.75 and a five-dollar bill. How much did the presents for the 4 boys cost? $35.00

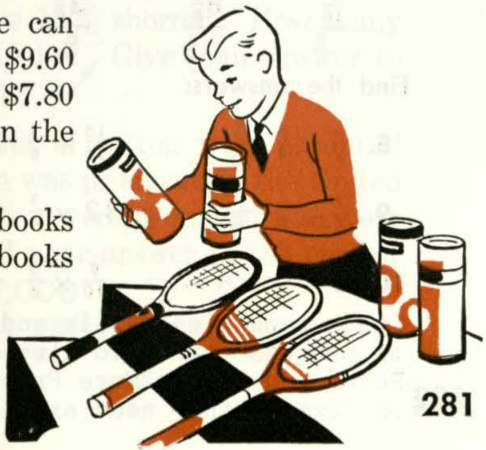
12. Nancy can buy a box of 3 small handkerchiefs for $.96 or a box of 3 large handkerchiefs for $1.29. How much more does one of the large handkerchiefs cost than one of the small handkerchiefs? $.11

13. How much less is the cost of 8 balls of yarn at $.68 each than the cost of 8 balls of yarn at $.81 each? $1.04

14. Mr. Hunt wants to buy 4 new tires for his automobile. One kind of tire costs $22.90 and another kind costs $27.40. Find the difference in the cost of 4 tires of these two kinds. $18.00

15. At the Sports Center, George can buy one kind of tennis ball at $9.60 a dozen and another kind at $7.80 a dozen. Find the difference in the price per ball. $.15

16. How much less is the cost of 9 books at $1.75 each than the cost of 9 books at $2.29 each? $4.86



Provide end-of-year test on common fractions.

Review of Fractions

1. At a sale Ellen bought three pieces of the same material marked down from the regular price. The lengths of the pieces were $1\frac{7}{8}$ yd., $2\frac{1}{2}$ yd., and $1\frac{1}{4}$ yd. How much of this material did Ellen have all together? $5\frac{5}{8}$ yd.

2. Judy bought a 5-pound bag of sugar. If she uses $1\frac{1}{2}$ lb. of sugar to make candy, how much sugar will be left? $3\frac{1}{2}$ lb.

3. Find the perimeter of a rectangle $9\frac{7}{8}$ in. by $15\frac{1}{4}$ in. $50\frac{1}{4}$ in.

Add. Check by going over your work:

4.	$\frac{7}{8}$	$2\frac{2}{3}$	$2\frac{1}{2}$	$7\frac{3}{16}$	$4\frac{1}{4}$	$9\frac{1}{6}$	$8\frac{9}{10}$
	$\frac{5}{8}$	$6\frac{5}{6}$	$1\frac{3}{4}$	$5\frac{7}{8}$	$4\frac{1}{3}$	$1\frac{3}{4}$	$4\frac{3}{5}$
	$1\frac{1}{2}$	$9\frac{1}{2}$	$4\frac{1}{4}$	$13\frac{1}{16}$	$8\frac{7}{12}$	$10\frac{11}{12}$	$13\frac{1}{2}$
5.	$\frac{7}{12}$	$2\frac{3}{8}$	$2\frac{3}{4}$	$1\frac{9}{10}$	$2\frac{1}{12}$	$1\frac{1}{4}$	$5\frac{5}{12}$
	$\frac{1}{12}$	$1\frac{1}{2}$	$3\frac{3}{4}$	$2\frac{1}{2}$	$2\frac{5}{6}$	$2\frac{1}{2}$	$2\frac{1}{4}$
	$\frac{1}{12}$	$7\frac{3}{4}$	$6\frac{3}{4}$	$2\frac{2}{5}$	$3\frac{2}{3}$	$1\frac{1}{3}$	$8\frac{2}{3}$
	$\frac{3}{4}$	$11\frac{5}{8}$	$13\frac{1}{4}$	$6\frac{4}{5}$	$8\frac{7}{12}$	$5\frac{1}{12}$	$16\frac{1}{3}$

Subtract. Check by going over your work:

6.	$\frac{7}{8}$	$5\frac{3}{4}$	$7\frac{1}{2}$	$6\frac{2}{3}$	8	$2\frac{1}{2}$	$5\frac{1}{8}$
	$\frac{1}{2}$	$1\frac{1}{2}$	$4\frac{5}{6}$	$2\frac{3}{4}$	$2\frac{5}{8}$	$1\frac{3}{4}$	$2\frac{5}{16}$
	$\frac{3}{8}$	$4\frac{1}{4}$	$2\frac{2}{3}$	$3\frac{11}{12}$	$5\frac{3}{8}$	$\frac{3}{4}$	$2\frac{13}{16}$
7.	$\frac{7}{10}$	$9\frac{1}{8}$	$8\frac{3}{4}$	$7\frac{9}{16}$	$8\frac{1}{4}$	$2\frac{1}{5}$	$9\frac{9}{10}$
	$\frac{3}{10}$	$8\frac{5}{8}$	$3\frac{3}{4}$	$4\frac{3}{8}$	$3\frac{5}{6}$	$1\frac{1}{2}$	$4\frac{1}{2}$
	$\frac{2}{5}$	$\frac{1}{2}$	5	$3\frac{3}{16}$	$4\frac{5}{12}$	$\frac{7}{10}$	$5\frac{2}{5}$

Find the answers:

8. $\frac{1}{2} \times \frac{5}{8}$ $\frac{5}{16}$ $\frac{15}{16} \div \frac{5}{8}$ $1\frac{1}{2}$ $2\frac{1}{2} \times 2\frac{1}{2}$ $6\frac{1}{4}$ $18 \div 1\frac{1}{2}$ 12

9. $\frac{7}{8} \div 2$ $\frac{7}{16}$ $12 \times \frac{3}{4}$ 9 $2\frac{1}{2} \div 1\frac{1}{4}$ 2 $5\frac{3}{4} \times 30$ $172\frac{1}{2}$

10. $8 \div \frac{1}{3}$ 24 $\frac{9}{10} \times \frac{5}{6}$ $\frac{3}{4}$ $1\frac{1}{8} \div 12$ $\frac{3}{32}$ $1\frac{1}{2} \times 2\frac{1}{4}$ $3\frac{3}{8}$

Check papers carefully and record kinds of errors and causes on progress cards to give summary of pupils' abilities. Refer pupils to "More Practice" pages or specific pages in text if they need extra summer work.

Finding a Per Cent of a Number

1. **Problem** Mr. White grows strawberries. He agreed to send 65% of his strawberries to the city market and will sell the rest of them at his roadside stand. One day he had 81 crates of berries. How many crates should he send to the city market?

   Explanation To find 65% of 81 you multiply 81 by .65, which gives 52.65. But you want an answer which is a whole number. If you round off 52.65 to the nearest whole number you get 53. Why? So Mr. White should send 53 crates of strawberries to the city market.

   Stress.→ **When you find a per cent of a number, it is often desirable to round off the answer.**

2. John read in the school paper that only 53% of the pupils at the West School were able to get to school on the day of the big snowstorm. There are 248 pupils at the West School. How many pupils attended school on the day of the big snowstorm? 131 Round off your answer to the nearest whole number.

3. In a drive for new members, the Boy Scouts of Grover City hope to increase their membership 25%. There were 419 Boy Scouts before the drive began. How many new members must they get in order to reach their goal? 105

4. Mary read that 92% of a watermelon is water. How many pounds of water are there in a watermelon which weighs 17 lb.? Round off your answer to the nearest tenth of a pound. 15.6

5. Bob made a trip of 791 miles with his family to visit his grandparents. Bob's father said that they would return by a different route which would be 18% shorter. How many miles shorter will the return trip be? Give your answer to the nearest tenth of a mile. 142.4

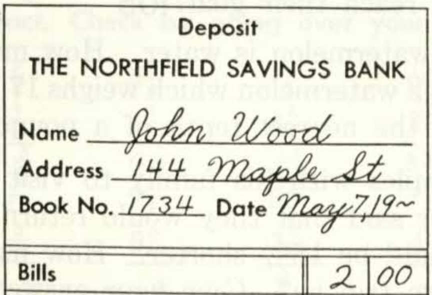
6. In a recent year 46,900,000 bales of cotton were produced in the world. 30% of this cotton was produced in the United States. How many bales of cotton were produced that year in the United States? Round off your answer to the nearest hundred thousand bales. 14,100,000

Have pupils make up additional examples using per cents. Discuss rounding off the answers.

Give information on saving money, including method of opening savings account in bank.

Savings Accounts

1. John had been saving money for several weeks. He wanted a safe place to keep his money, so his father suggested that John go with him to the savings bank and open a **savings account.**



Deposit

THE NORTHFIELD SAVINGS BANK

Name John Wood

Address 144 Maple St

Book No. 1734 Date May 7, 19–

Bills	2	00
Coin		75
Checks		
Total	2	75

2. At the bank John had to fill out a card, giving his name and address. He then filled out a **deposit slip** like the one at the left, which showed how much money he wanted to **deposit.** John gave the deposit slip and his money to the man behind the counter who is called the **teller.** Every time that John takes money to the savings bank he must make out a deposit slip to give to the teller with his money. If John leaves his money

Ex. 1-3 should be discussed thoroughly with pupils. Be sure they understand meaning of "savings account," "deposit," "teller," "interest," "withdraw." Encourage pupils who have savings accounts to tell class of their experiences in opening them, and so on.

in the bank long enough, the bank will pay him a small amount, called **interest,** for the use of the money. In some savings banks interest is paid every 3 months; in other savings banks interest is paid every 6 months.

3. When the teller received John's money and the deposit slip, he gave John a **deposit book** upon which he wrote John's name and address. On the first page of the book the teller put the date and the amount of John's deposit. John takes his deposit book with him each time he deposits money in the bank. If John should take out, or **withdraw,** any money, he would also need his deposit book, for the teller must also put in the book any amounts John withdraws.

4. John's first deposit was $2.75 and was made on May 7. On May 20, he made another deposit of $1.20. How much did he have in the savings bank then? $3.95 The $1.20 that John deposited on May 20 was 1 half dollar, 2 quarters, and 2 dimes. Make a deposit slip like the one on page 284 for the deposit of May 20.

5. John deposited $1.35 on May 29 and $1.55 on June 12. The money for both of these deposits was all in coin. Write the two deposit slips for these deposits. How much money did John have in the bank after his deposit of June 12? $6.85

6. John received $5.00 from his uncle. On June 15, he deposited this gift and $1.50 more in the bank. He took to the bank 1 five-dollar bill, 1 dollar bill, and 2 quarters. Write the deposit slip for the deposit on June 15. How much did John have in the bank then? $13.35

7. On June 21, John withdrew $2.75 from his savings account to buy his mother a birthday present. How much did he have in the bank after that? $10.60

8. Get a deposit slip from a savings bank in your city and bring it to class. Have pupils fill them out and post on bulletin board for further reference.

9. If the schools in your city have a school savings bank, find out how many pupils are depositors and the total amount of their deposits.

Have forms available, like the one on page 284, for pupils to use in making out deposit slips. If possible, have pupils display their deposit books so others may see how information is recorded.

Problems without Numbers

1. You know how much you paid for a football at the sale. You know the regular price of the football before the sale. How do you find how much you saved by buying at the sale? Subtract

2. You know how many times you went to the movies last month. You know how much money you spent all together for movie tickets. How do you find the average price you paid per ticket? Divide

3. You know the amount of your allowance each week and the amount of money you earn delivering papers each week. How do you find the total amount you get each week? Add

4. You know how many eggs the hens laid during this week. You want to put the eggs in boxes containing one dozen each. How do you find how many boxes you will need? Divide

5. You know how much money you had when you went to the store. You know how much money you have left. How do you find how much money you spent? Subtract

6. You know how many miles a car averages on one gallon of gasoline. You know how many gallons of gasoline there are in the tank. How do you find how many miles the car can travel on that amount of gasoline? Multiply

7. You know how much Peter paid for his bicycle. You know how much you paid for your bicycle. How do you find the difference between the prices of the two bicycles? Subtract

8. You know the number of miles your father drove his car on a trip and the number of hours he drove. How do you find the average number of miles per hour he drove? Divide

9. You know how much you paid for the cloth for your dress. You know how many yards of cloth you bought. How do you find the price of the cloth per yard? Divide

10. You know how many bus tickets you will need during the month of September. You know the cost of one ticket. How do you find the cost of bus tickets for that month? Multiply

If pupils have difficulty in solving these problems, suggest that they supply numbers for each problem, solve it, then tell in general terms what they did. When discussing solutions, have pupils give reasons for processes chosen.

Review Problems

1. Mr. Grant has an orange grove. He packed and sold 7385 boxes of oranges. There were 2150 boxes that held 150 oranges each, 2475 boxes that held 176 oranges each, and the rest held 220 each. How many oranges did he sell? 1,365,300

2. How many dozen oranges in all did Mr. Grant sell? 113,775 See ex. 1.

3. Mrs. Ball drove her car 500 mi. and used 32 gal. of gasoline. Find, to the nearest tenth of a mile, the average number of miles Mrs. Ball drove per gallon of gasoline. 15.6

4. Mrs. Ball paid \$.289 per gallon for 10 gal. of gasoline, \$.326 per gallon for another 10 gal., and \$.295 per gallon for the rest of the 32 gal. Find the total amount Mrs. Ball paid for all the gasoline for her trip of 500 mi. \$9.69

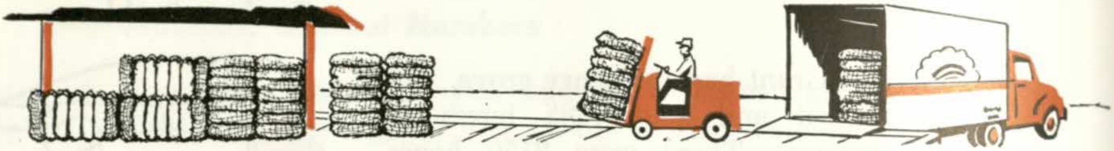
5. On a scale drawing of a room, $\frac{1}{8}$ in. stands for 1 ft. If the length of the room in the drawing is $2\frac{3}{4}$ in., how long is the actual room? 22 ft. If the width of the room is $1\frac{7}{8}$ in., how many feet wide is the actual room? 15

6. Mr. Brown has three lots for sale, all rectangular in shape. One is 80 ft. by 140 ft., (11,200 sq.ft.) another is 75 ft. by 150 ft., (11,250 sq.ft.) and a third is 90 ft. by 130 ft. (11,700 sq.ft.) Which lot has the largest area, and how much larger is it than each of the others? Last lot has largest area; 500 sq.ft. larger than first, and 450 sq.ft. larger than second.

7. One year the first day of June came on Saturday. How many Saturdays were there in June that year and what were their dates? (1) How many Sundays were there? (2) How many Mondays? (3) Give the dates of the Mondays. (3) (1) 5 Saturdays: June 1, 8, 15, 22, 29; (2) 5 Sundays; (3) 4 Mondays: June 3, 10, 17, 24

8. Draw a bar graph to show the heights of these big dams in the United States: Hoover, 726 ft.; Shasta, 602 ft.; Hungry Horse, 564 ft.

Show how the whole, or 100%, is made up of parts that total 100%.



Subtracting from 100%

1. In the United States 30% of the world's cotton is produced. What per cent of cotton is produced in other countries? 70%
▶ All of the cotton produced is 100% of it. If 30% of all the cotton is produced in the United States, the rest, or 70% of it, is produced in other countries. You find 70% by subtracting 30% from 100%.

2. Our basketball team won 75% of the games that it played. What per cent of the games did the basketball team lose? 25%

3. Mrs. Hart bought material for curtains which was made of rayon and cotton. If this material is 55% cotton, what per cent of it is rayon? 45%

4. Bob saves 15% of the money that he earns. What per cent of it does he spend? 85%

5. Jim's father gave him 75% of the price of a bicycle and Jim paid the rest by using some of his savings. What per cent of the price of the bicycle did Jim pay himself? 25%

6. In the sixth grade at the Camp School 45% of the pupils are boys. What per cent of the pupils are girls? 55%

7. The occupation of 9% of the workers in the United States is farming. What per cent of our workers have other occupations? 91%

8. Mr. Perry sold 60% of the peaches from his orchard at a roadside stand, sold 35% to stores, and kept the rest for home use. What per cent of his peaches did Mr. Perry keep for home use? 5%

9. Of the world's telephones, 57% are in North America and 30% are in Europe. What per cent of all telephones are in the rest of the world? 13%

Emphasize why we subtract from 100% (since 100% means all or the whole). Point out also that per cents all have same denominator. Have pupils make up similar problems.

Use review as end-of-year test. Remind pupils to read problems carefully (see page 212).

Review Problems

1. How much more must you pay for 3 books at $1.75 each than for 3 books at $.95 each? $2.40

2. Virginia is making a scale drawing. She is using $\frac{1}{4}$ in. to stand for 5 ft. How long should she draw a line that stands for 20 ft.? 1 in.

3. After George had sold all the blueberries he had picked, he had 4 half dollars, 9 quarters, 11 dimes, 7 nickels, and 10 pennies. How much money did George have? $5.80

4. A car dealer received 28 new cars that cost him $54,460. Find the average cost of each car to the dealer. $1945

5. A flier attempted to fly to a height of 45,000 ft. At a height of 44,940 ft. he was forced to drop back. How many feet was he short of the height he wished to reach? 60

6. Jane can knit $\frac{1}{4}$ in. of a scarf in 6 min. How many inches can she knit in $\frac{1}{2}$ hr.? $1\frac{1}{4}$ in 1 hr.? $2\frac{1}{2}$

7. Fred feeds his dog 1 lb. 4 oz. of dog food per day. How many days will a 25-pound bag of dog food last? 20

8. Last month Mr. Green spent $62.48 to run his car. He drove the car 725 mi. in all. Find, to the nearest cent, the cost per mile of running the car. 9¢

9. Jim read that a manufacturing company had reduced the cost of one kind of wire from $8\frac{3}{4}$¢ per foot to $5\frac{1}{2}$¢ per foot. This would be a saving of how many cents per foot? $3\frac{1}{4}$¢

10. At the reduced price given in ex. 9, what would be the saving on an order of 2500 ft. of wire? $81.25

11. Mrs. Bell received a bill for $6\frac{1}{2}$ lb. of meat at $.45 a pound, 2 doz. eggs at $.49 a dozen, 4 bars of soap at $.08 each, and $\frac{3}{4}$ lb. of cheese at $.56 a pound. Write the bill, supplying necessary names and dates. $4.65

12. The girls in the cooking class served lunch to 27 persons at a cost of $12.60. Find the cost per person. $.46$\frac{2}{3}$

Following skills and understandings are included: ex. 1: 3-step problem; ex. 2: scale drawing; ex. 4, 12: average costs; ex. 6: comparison of numbers; ex. 9, 10: common-fraction skills; ex. 11: bills of purchase.

Teach fractional equivalents of frequently used per cents.

Short Cuts

1. There are short cuts in finding certain per cents of a number that will be useful to you. For example, to find 25% of 84 you can multiply 84 by .25, which gives 21 as shown at **A.** A shorter way to get this result is to find $\frac{1}{4}$ of 84 as shown at **B.** $25\% = \frac{25}{100} = \frac{1}{4}$, so 25% of a number equals $\frac{1}{4}$ of it.

A

$$\begin{array}{r} 84 \\ \underline{.25} \\ 4\,20 \\ \underline{16\,8} \\ 21.00 \end{array}$$

B

$$\begin{array}{r} 21 \\ 4\overline{)84} \end{array}$$

Use the short cut in ex. 1 to find the answers:

2. 25% of 40 10 25% of 248 62 25% of $640 $160

3. 25% of 92 23 25% of 468 117 25% of $876 $219

4. There is a short way to find 50% of a number. $50\% = \frac{50}{100} = \frac{1}{2}$, so 50% of a number equals $\frac{1}{2}$ of it. Also $75\% = \frac{75}{100} = \frac{3}{4}$, so 75% of a number equals $\frac{3}{4}$ of it. If n stands for any number:

Stress.

$$25\% \text{ of } n = \tfrac{1}{4} \text{ of } n$$
$$50\% \text{ of } n = \tfrac{1}{2} \text{ of } n$$
$$75\% \text{ of } n = \tfrac{3}{4} \text{ of } n$$

Use short cuts to find the answers:

5. 25% of 800 200 50% of 432 216 75% of $ 52 $39

6. 50% of 716 358 25% of 128 32 75% of $448 $336

7. 75% of 164 123 50% of 972 486 25% of $336 $84

8. Henry sold his old bicycle for 50% of what he had paid for it. If Henry's bicycle cost $48, what did he sell it for? $24

9. Jane bought at a sale a coat which had a regular price of $30. The price of the coat was reduced 25% for the sale. How much did Jane save by buying the coat at the sale? $7.50

10. In Bob's school 75% of the pupils have school savings accounts. There are 240 pupils in Bob's school. How many of the pupils have school savings accounts? 180

11. Mr. Baker says that he spends about 50% of his income for housing and food for his family. His monthly income is $542. How much does Mr. Baker spend for housing and food each month? $271

Follow development as given in ex. 1. Be sure pupils see that 25% = $\frac{1}{4}$. Bring out fact that sometimes it is easier to use fractional equivalent by having pupils use decimal in some cases in ex. 5–7.

Present last sets of improvement tests
in multiplication and division.

Improving by Practice

Multiplication Test 5a. Time: 4 min. after copying.

1. 4768	1945	6579	2803	
148	573	925	706	④
705,664	1,114,485	6,085,575	1,978,918	

Multiplication Test 5b. Time: 4 min. after copying.

2. 5296	3067	8193	7584	
427	256	309	198	④
2,261,392	785,152	2,531,637	1,501,632	

Multiplication Test 5c. Time: 4 min. after copying.

3. 1597	3802	9863	4675	
605	294	817	639	④
966,185	1,117,788	8,058,071	2,987,325	

Division Test 5a. Time: 6 min. after copying.

	7283	6900 R 11	8154	
4.	35)254905	19)131111	46)375084	⑤
	5009 R 19	5763		
5.	54)270505	28)161364		

Division Test 5b. Time: 6 min. after copying.

	6395	4718	3800 R 43	
6.	29)185455	51)240618	47)178643	⑤
	6008 R 11	5279		
7.	62)372507	36)190044		

Division Test 5c. Time: 6 min. after copying.

	4592	7086	8600 R 19	
8.	38)174496	27)191322	25)215019	⑤
	5319	7003 R 3		
9.	63)335097	49)343150		

To the Pupil. In ex. 4–9, write R before remainders. These are the last sets of Improvement Tests in multiplication and division you will have this year. Try to get a score of 10 on each test.

Compare results of these tests with previous ones as noted in pupils' Score Books. Improvements and/or weaknesses should be recorded on progress cards. Try to clear up difficulties through individual conferences with pupils.

Teach rounding off of money correct to the nearest cent.

Rounding Off to the Nearest Cent

1. **Problem** Mrs. Miller found a table that she wants to buy. Its regular price is $63.25. During the furniture sale its price will be reduced 15%. How much will Mrs. Miller save if she buys the table during the sale?

Explanation Find 15% of $63.25 as shown at the right. The answer is $9.4875. This becomes $9.49 when rounded off **to the nearest cent,** because $9.4875 is closer to $9.49 than it is to $9.48. Mrs. Miller will save $9.49 if she buys the table during the sale.

$63.25
.15
316 25
632 5
$9.4875

If the answer had been $9.4825, you would call it $9.48 **to the nearest cent.** Why? If the answer had been $9.4850, which is halfway between $9.48 and $9.49, you would call it $9.49 **to the nearest cent.**

When an answer is rounded off to the nearest cent it is said to be **correct to the nearest cent.** Be sure pupils understand this.

2. During the sale at the Sports Center the prices of all sports equipment are reduced 20%. If you buy during the sale a tennis racket with a regular price of $13.89, how much will you save? $2.78 If you buy a croquet set with a regular price of $22.39, how much will you save? $4.48

Give oral practice in rounding off money before assigning.

Find the answers correct to the nearest cent:

3. 5% of $43.75 $2.19 15% of $36.87 $5.53 4% of $836.21 $33.45

4. 7% of $28.65 $2.01 32% of $14.53 $4.65 2% of $564.15 $11.28

5. 2% of $84.89 $1.70 28% of $62.50 $17.50 9% of $125.54 $11.30

6. 4% of $51.23 $2.05 13% of $76.22 $9.91 1% of $692.50 $6.93

7. 1% of $94.76 $.95 53% of $18.95 $10.04 5% of $263.75 $13.19

8. 6% of $45.82 $2.75 75% of $12.13 $9.10 6% of $260.14 $15.61

9. 9% of $39.47 $3.55 50% of $69.19 $34.60 7% of $519.40 $36.36

Conduct quick review of rounding off decimals as given on p. 207. Then discuss ex. 1 with class.

Teach how to find rate of discount when purchase is made at reduced price.

Buying at a Discount

1. **Problem** Jim and his father bought some lumber with which to make bookcases. The bill for the lumber was \$38. If the bill is paid within 10 days they will receive a **discount** of 2%. How much will the lumber cost if the bill is paid within 10 days? \$37.24

   Explanation If paid within 10 days the bill will be reduced 2%. The amount of the deduction is called the **discount** and the per cent of reduction is called the **rate of discount.** Stress. So the discount on the bill, if paid within 10 days, will be 2% of \$38, which is \$.76. To find the reduced amount of the bill subtract \$.76 from \$38, which gives \$37.24. The cost of the lumber will be \$37.24.

2. Jean saw an advertisement of a clothing sale in the newspaper. During this sale all sweaters and skirts will be sold at a discount of 25%. If Jean buys a sweater with a regular price of \$9.00 and a skirt with a regular price of \$12.75, what will be the discount on each? \$2.25; \$3.19 How much will she have to pay for the sweater and for the skirt? \$6.75; \$9.56

3. Ted works at Wilson's Music Store on Saturdays. Mr. Wilson told Ted that he could have a discount of 20% on any of his purchases since he works in the store. Ted wants to buy a record player which has a regular price of \$32.50. How much will his discount be and how much will he have to pay for this record player? \$26.00 \$6.50

4. At the end of the summer during a sale, Mr. Green bought a power lawnmower at 15% off its regular price. Its regular price was \$137.95. How much did Mr. Green pay for the lawnmower? \$117.26

5. Look in several newspapers for some advertisements of things being sold at a discount. Bring the advertisements to class and use them to help you make up three problems about discounts.

Point out that rate of discount means "per cent" of discount. Lead pupils to see which two numbers are to be compared (amount of discount and original price). Pupils might make up similar problems based on advertisements of sales.

Present test of arithmetic vocabulary.

The Language of Arithmetic

Read the statements below and tell the correct word to put in each space. Do not write in the spaces:

1. When you say that 3,871,900 is about 4,000,000, you call 4,000,000 a round number

2. A number that is exactly divisible by 2 is called an even number

3. A number that is not exactly divisible by 2 is called an odd number

4. When you find how many square feet a rectangular lot contains, you are finding its area.

5. .3 is a decimal fraction, but $\frac{3}{10}$ is a common fraction.

6. When one apple is divided into 4 equal parts, each part is called a fourth or quarter

7. When you add 4 numbers and divide the sum by 4, you are finding the average of the numbers.

8. When you divide the distance traveled by the number of hours that were used, the answer is the rate or speed

9. The second place to the right of the decimal point is called hundredths place.

10. The third place to the left of the decimal point is called hundreds place.

11. When you drop the 3 of the number 17.83 and call it 17.8, you have rounded off 17.83 to the nearest tenth.

12. When you drop the 8 of the number 3.268 and call it 3.27, you have rounded off 3.268 to the nearest hundredth

13. A number that has twelve places stands for hundred billions

14. The number 12 ft. 4 in. is called a ------ number.

15. When you put money in the savings bank, you make out a deposit slip to give to the teller with your money.

Group pupils who had errors to ascertain causes. If lack of understanding is basic cause, redevelop terms, stressing meanings.

Present end-of-year test in division and multiplication of mixed decimals. Results of test should be entered on progress cards to give summary of pupils' abilities.

Placing the Decimal Point

Put the decimal point in the correct position in each quotient, supplying zeros if necessary:

1. $\overset{3.8}{.4\overline{)1.52}}$ $\overset{740.}{.02\overline{)14.8}}$ $\overset{3900.}{.09\overline{)351}}$ $\overset{56.}{.114\overline{)6.384}}$

2. $\overset{147.}{.3\overline{)44.1}}$ $\overset{17.}{.12\overline{)2.04}}$ $\overset{12.}{1.4\overline{)16.8}}$ $\overset{2.7}{2.38\overline{)6.426}}$

3. $\overset{.73}{.5\overline{).365}}$ $\overset{23.6}{.04\overline{).944}}$ $\overset{.07}{2.5\overline{).175}}$ $\overset{.32}{19.4\overline{)6.208}}$

4. $\overset{.07}{.9\overline{).063}}$ $\overset{178.}{.03\overline{)5.34}}$ $\overset{.2}{.16\overline{).032}}$ $\overset{480.}{.062\overline{)29.76}}$

5. $\overset{.13}{.7\overline{).091}}$ $\overset{11.5}{.08\overline{).920}}$ $\overset{12{,}900.}{.04\overline{)516}}$ $\overset{1700.}{1.25\overline{)2125}}$

6. $\overset{36.}{.6\overline{)21.6}}$ $\overset{820.}{.11\overline{)90.2}}$ $\overset{1.6}{4.3\overline{)6.88}}$ $\overset{8390.}{.007\overline{)58.73}}$

7. $\overset{2090.}{.2\overline{)418}}$ $\overset{.6}{.07\overline{).042}}$ $\overset{4.7}{.05\overline{).235}}$ $\overset{40{,}600.}{.009\overline{)365.4}}$

8. $\overset{.07}{.4\overline{).028}}$ $\overset{840.}{.06\overline{)50.4}}$ $\overset{2.7}{3.1\overline{)8.37}}$ $\overset{5600.}{.127\overline{)711.2}}$

Tell where the decimal point belongs in each product:

9. 16 × 2.86 = 45.76 .037 × 462 = 17.094

10. 43 × .129 = 5.547 1.29 × 41.3 = 53.277

11. 27 × .075 = 2.025 6.25 × 10.7 = 66.875

12. 14 × 68.2 = 954.8 .143 × 628 = 89.804

13. .09 × 99.2 = 8.928 .094 × 173 = 16.262

14. .59 × 63.4 = 37.406 34.7 × 41.2 = 1429.64

15. 8.3 × 4.53 = 37.599 63.4 × 9.26 = 587.084

16. 2.9 × 8.07 = 23.403 18.9 × 93.8 = 1772.82

Note that placing the decimal point is main understanding being tested. If pupils evidence difficulties, review further using developmental material in text.

Review Problems

1. On a holiday Mary took 3 friends to the movies and afterwards bought them ice cream. Each movie ticket cost \$.50 and each dish of ice cream cost \$.15. How much did Mary spend for her friends and herself? \$ 2.60

2. Nancy's mother made a gallon of ice cream for Nancy's birthday party. The materials for it cost \$1.78. The ice cream was served to 28 persons. What was the average cost of the ice cream per dish? \$.06 Give the answer to the nearest cent.

3. Tom and Bob bought 25 lb. of peanuts for \$9.35 and small paper bags for \$.25. They put 4 oz. of peanuts in each bag and sold the bags at \$.15 each. How much money did each boy make if they shared the money equally? \$ 2.70

4. Ellen can ride her bicycle $\frac{1}{4}$ mi. in 2 min. How many minutes does it take her to ride 1 mi.? 8 How many miles can Ellen ride in an hour? $7\frac{1}{2}$

5. Jim bought a package of 75 stamps for 50¢. At this price, how many stamps would he get for a dime? 15 for a dollar? 150 What would be the cost of 3 stamps? 2 ¢

6. Draw a line graph to show these changes in temperature from 9 A.M. to 5 P.M. See G-111.

Hours	9	10	11	12	1	2	3	4	5
Degrees	65	68	73	75	79	78	78	76	75

7. As treasurer of the class Peter received these amounts of money in April: \$1.15, \$.48, \$2.25, \$1.84, \$4.00, \$.60, \$5.25, \$.70, \$1.50. He paid bills for these amounts: \$2.65, \$8.32, \$.72, \$5.66. Balance the account and tell how much **cash on hand** he should have at the end of April. \$.42

These problems may also be given as end-of-year test (see also pages 287 and 289). Pupils who have done well on other problem tests might help those pupils who still have difficulty in solving problems.

Provide mixed practice in common and decimal fractions, and whole numbers.

Mixed Practice

1. Round off each number to the nearest hundred:
729 700 473 500 890 900 217 200 688 700 192 200

2. Round off each number to the nearest thousand:
4128 4000 2912 3000 6889 7000 5278 5000 7826 8000 3981 4000

3. Round off each decimal to the nearest tenth:
4.18 4.2 7.84 7.8 3.25 3.3 18.81 18.8 34.69 34.7 25.97 26.0

4. Round off each decimal to the nearest hundredth:
.916 .92 .472 .47 .909 .91 3.777 3.78 5.098 5.10 8.761 8.76

5. Read these numbers: 276,814 276 thousand, 814 4,950,136 4 million, 950 thousand, 136 62,475,000 62 million 475 thousand
125,800,000 125 million, 800 thousand 3,218,792,000 3 billion, 218 million, 792 thousand 19,783,436,700 19 billion, 783 million, 436 thousand, 7 hundred

6. Read these numbers: CIX 109 CCLX 260 CCXLV 245
DCLXI 661 MCXL 114 MDC 1600 MDCCXX 1720 MCMLVII 1957

7. From the sum of $3\frac{5}{8}$ and $1\frac{3}{4}$ subtract $3\frac{7}{8}$. $1\frac{1}{2}$

8. From the product of 8 and $3\frac{1}{2}$ subtract $9\frac{1}{4}$. $18\frac{3}{4}$

9. Find the average of 15,622; 18,428; 17,905; and 24,077. 19,008

10. Find the average of 12.25, 15.68, 11.92, and 7.75. 11.90

11. Find the average of $2\frac{1}{2}$, $1\frac{3}{4}$, 3, $4\frac{3}{8}$, $4\frac{5}{8}$, and $3\frac{3}{4}$. $3\frac{1}{3}$

12. How much less than $400 is $175.33? $224.67

13. Add to 6.3 the difference between 29.6 and 21.9. 14.0

14. Multiply 6.5 by .9 and divide the product by .05. 117

15. Subtract the sum of $243, $471, and $185 from $1000. $101

16. Copy the four examples below with their answers:

$1.75	multiplicand	$8.27	minuend	$1.76	quotient	$215	addends
×3	multiplier	−1.89	subtrahend	4)$7.04	dividend	+198	
$5.25	product	$6.38	remainder	divisor		$413	sum

Then write after each number the word that tells what the number is called. In the first example, write **multiplicand** after $1.75. What word will you write after 3? after $5.25?

Try to determine if processes, concepts, skills, or vocabulary, and so on, cause difficulty. Conduct specialized reviews for those pupils who need them. Let others work on magic squares, using decimal or common fractions.

Review problem solving with problems which have extra facts.

Which Numbers Are Not Needed?

Tell which numbers are not needed to answer the question in the problem. Then work the problem:

1. At a filling station regular gasoline costs $.295 a gallon and special gasoline costs $.325 a gallon. How much does Mr. Clark pay for 12 gal. of regular gasoline? "$.325" not needed; $3.54

2. Last week Jane received these amounts of money: $.75 for her allowance, $.70 for helping Mrs. King 2 hr., $.95 for selling 2 used books, $.75 for doing 3 errands, and $1.25 for baby-sitting for 2 hr. How much money in all did Jane receive last week? "2 hr.," "2 used books," "3 errands," and "2 hr.," not needed; $4.40

3. From a piece of cloth containing $21\frac{1}{4}$ yd., a clerk cut off $4\frac{1}{2}$ yd. for Mrs. Booth. At \$1.75 a yard, how much did Mrs. Booth pay for the cloth she bought? "$21\frac{1}{4}$ yd." not needed; \$7.88

4. At 6:45 A.M. Mr. Baker left home in his truck with 120 doz. eggs to sell in the city. He arrived in the city at 8:00 A.M. after driving 35 mi. What was his average speed in miles per hour? "120 doz." not needed; 28

5. John's father is 6 ft. 2 in. tall and weighs 175 lb. John is 4 ft. 10 in. tall and weighs 89 lb. How much taller is John's father than John? "175 lb." and "89 lb." not needed; 1 ft. 4 in.

6. Nancy and her mother made sandwiches for Jim's birthday party. They had 4 loaves of bread, $\frac{3}{4}$ lb. of butter, 2 jars of jam, and 2 jars of peanut butter. They made 96 sandwiches and all but 8 were eaten. How many sandwiches were eaten? ← "4 loaves," "$\frac{3}{4}$ lb." "2 jars," and "2 jars" not needed; 88

7. In the city where Jean lives it costs $2\frac{1}{4}$¢ an hour for electricity to use a toaster and $3\frac{1}{2}$¢ an hour for electricity to use an electric iron. If Jean's mother uses her iron an average of 25 hr. a month, what does the electricity for the iron cost? ← "$2\frac{1}{4}$¢" not needed; 88¢

8. Mary saw a glass tank measuring 6 in. × 8 in. × 11 in. and another measuring 6 in. × 7 in. × 11 in. If she bought the second tank, how many gallons of water are needed to fill it to the top? 231 cu. in. = 1 gal. "6 in. x 8 in. x 11 in." not needed; 2

When discussing answers to ex. 1-8 have pupils give reasons why some facts were unnecessary. Group pupils who did poorly and have them do similar activity under your direction.

Review long division where remainders are expressed both as decimal fractions and whole numbers.

Review of Division

Tell the word that goes in each space. Do not write in the spaces:

1. When the second figure of the divisor is 1, 2, 3, 4, or 5, divide by the first figure of the divisor to estimate the quotient figure.

2. When the second figure of the divisor is 6, 7, 8, or 9, divide by 1 more than the first figure of the divisor to estimate the quotient figure.

Divide, writing enough 0's after the decimal point to avoid a remainder. Check the work:

6.125 .625 19.5 7.32 8.25
3. 8)49.000 32)20.000 18)351.0 25)183.00 44)363.00

14.5 .6 11.8 12.9 19.4
4. 6)87.0 25)15.0 45)531.0 70)903.0 25)485.0

13.75 .375 12.5 6.48 2.875
5. 4)55.00 56)21.000 64)800.0 75)486.00 72)207.000

Divide. Carry the quotient to three decimal places; then round off the result correct to the nearest hundredth:

17.67 .91 5.17 7.80 1.35
6. 3)53 11)10 36)186 61)476 74)100

15.17 .76 4.81 9.58 2.91
7. 6)91 17)13 43)207 12)115 86)250

8.33 .83 6.79 7.25 3.43
8. 9)75 23)19 19)129 57)413 91)312

Divide and write R before any remainder. Check by multiplying:

84R15 947 83 457R211
9. 78)6567 21)19887 612)50796 284)129999

95R18 838R25 48R5 422
10. 64)6098 67)56171 772)37061 591)249402

92R29 956 217 619R89
11. 87)8033 32)30592 418)90706 332)205597

283 5728 272R191 234R152
12. 29)8207 15)85920 295)80431 462)108260

187R3 2060 286R103 2007
13. 37)6922 34)70040 309)88477 325)652275

152 2129 76 2200
14. 38)5776 31)65999 430)32680 356)783200

Remind pupils that if an answer will not come out evenly after it has been carried to two or three places, a plus sign should be added at end of the quotient.

Oral Practice

Give the answers only. Do the work mentally:

1. Count by 7's from 38 to 94;(1) from 110 to 173.(2) (1) 38, 45, 52, 59, 66, 73, 80, 87, 94; (2) 110, 117, 124, 131, 138, 145, 152, 159, 166, 173

2. Count by 8's from 14 to 86;(1) from 95 to 151.(2) (1) 14, 22, 30, 38, 46, 54, 62, 70, 78, 86; (2) 95, 103, 111, 119, 127, 135, 143, 151

3. Count by 9's from 50 to 122;(1) from 132 to 195.(2) (1) 50, 59, 68, 77, 86, 95, 104, 113, 122; (2) 132, 141, 150, 159, 168, 177, 186, 195

4. How many figures are there in the number four billion? 10

5. Round off 6,846,219,729 to the nearest billion. 7,000,000,000

6. Read these numbers: MDCXII, 1612 MCMXV, 1915 MCMLXI. 1961

7. Change to mixed numbers: $\frac{13}{4}$, $3\frac{1}{4}$ $\frac{14}{5}$, $2\frac{4}{5}$ $\frac{11}{3}$, $3\frac{2}{3}$ $\frac{19}{2}$, $9\frac{1}{2}$ $\frac{14}{6}$. $2\frac{1}{3}$

8. Change to fractions: $4\frac{2}{3}$, $\frac{14}{3}$ $8\frac{1}{2}$, $\frac{17}{2}$ $7\frac{1}{4}$, $\frac{29}{4}$ $2\frac{4}{5}$, $\frac{14}{5}$ $1\frac{7}{8}$. $\frac{15}{8}$

9. Change to fractions: .4, $\frac{2}{5}$ .72, $\frac{18}{25}$ .07, $\frac{7}{100}$ .041, $\frac{41}{1000}$ .009. $\frac{9}{1000}$

10. Change to decimals: $\frac{1}{10}$, .1 $\frac{17}{100}$, .17 $\frac{283}{1000}$, .283 $\frac{9}{100}$, .09 $\frac{29}{1000}$. .029

11. Change to lowest terms: $\frac{6}{9}$, $\frac{2}{3}$ $\frac{8}{28}$, $\frac{2}{7}$ $\frac{25}{30}$, $\frac{5}{6}$ $\frac{28}{40}$, $\frac{7}{10}$ $\frac{8}{48}$. $\frac{1}{6}$

12. Find the sum of 2 lb. 4 oz. and 3 lb. 9 oz. 5 lb. 13 oz.

13. Change to ounces: 1 lb. 9 oz.; 25 3 lb. 2 oz.; 50 2 lb. 7 oz. 39

14. Change to inches: 2 ft. 5 in.; 29 4 ft. 2 in.; 50 3 ft. 11 in. 47

15. Change to minutes: 1 hr. 17 min.; 77 2 hr. 20 min. 140

16. Change to quarts: 3 gal. 2 qt.; 14 5 gal. 3 qt.; 23 9 gal. 1 qt. 37

17. At 3 marbles for 10¢, find the cost of 18 marbles. 60¢

18. At 12 apples for 39¢, find the cost of 4 apples. 13¢

19. What part of a bushel is 2 pk.? $\frac{1}{2}$

20. What part of a ton is 200 lb.? $\frac{1}{10}$

21. Find the average of 8, 6, 3, 9, 4. 6

22. At the rate of 40 mi. per hour, how far can Mr. Green drive in 2 hr.? 80 mi. in 3 hr.? 120 mi. in 30 min.? 20 mi. in 45 min.? 30 mi.

23. At the rate of 3 mi. an hour, how long will it take Henry to walk 6 mi.? 2 hr. 1 mi.? $\frac{1}{3}$ hr. 4 mi.? $1\frac{1}{3}$ hr. 2 mi.? $\frac{2}{3}$ hr.

Present the last problem test.

A Problem Test

1. The members of the Outing Club walked 12 mi. to Mirror Lake in $3\frac{3}{4}$ hr. Find their average speed in miles per hour? $3\frac{1}{5}$

2. On another day the Outing Club members climbed to the top of West Rock. The distance was only $3\frac{1}{4}$ mi., but it took them $2\frac{1}{2}$ hr. Find their average speed climbing to the top of West Rock. $1\frac{3}{10}$

3. Ellen can buy a radio with 5 tubes for \$19.95 or one with 6 tubes for \$26.35. What is the difference between the prices of these two radios? \$6.40

4. Bob saw an advertisement of a sale of boys' clothing at a discount of 20%. If Bob buys at this sale a sport jacket which has a regular price of \$18.75, how much will it cost? \$15.00

5. How much will $\frac{3}{4}$ bu. of apples cost at \$3.50 a bushel? \$2.63

6. Mr. Wood is making an automobile trip today. These are the distances between towns he will visit: 16.2 mi., 26.5 mi., 49.0 mi., 18.2 mi., 28.9 mi., and 30.7 mi. How many miles is the whole trip? 169.5

7. Mr. Young's expenses for 3 trips to Chicago were: \$134.86, \$191.50, and \$153.25. Find the average cost per trip. \$159.87

8. On a holiday there were 189 cars in line waiting to cross the river on a ferry. If the ferry can carry 16 cars on one trip, how many trips must it make to take 189 cars over? 11R13, or 12

9. It costs \$.85 to take a car and passengers across the river on the ferry. How much was received from 189 cars? \$160.65

10. One kind of wire costs \$.04 per ft. How many feet can you buy for \$5.00? 125

Look below to find out what your score means.

Have pupils complete their bar graphs started on page 41.

SCORE	0–5 You need help	6–7 Fair	8–9 Good	10 Excellent

Record summary of results of these problem tests on progress cards. Discussion of problems will still be helpful at this time to reinforce pupils' skills in problem solving.

Provide diagnostic tests (pages 302-303) of skills taught in Grade 6, with practice-page references.

How Much Have You Learned?

If you miss more than one example in a row, turn to the Practice Pages for that row.

Add. Check by going over the work:

						Practice Pages
1.	$5\frac{1}{2}$	$8\frac{1}{2}$	$4\frac{7}{12}$	$3\frac{1}{2}$	$2\frac{3}{4}$	64, 65
	$2\frac{3}{4}$	$2\frac{2}{3}$	$2\frac{3}{4}$	$4\frac{1}{5}$	$7\frac{1}{3}$	
	$2\frac{5}{8}$	$4\frac{5}{6}$	$2\frac{1}{2}$	$2\frac{7}{10}$	$3\frac{1}{2}$	
	$10\frac{7}{8}$	16	$9\frac{5}{6}$	$10\frac{2}{5}$	$13\frac{7}{12}$	

Subtract. Check by going over the work:

2.	$8\frac{7}{8}$	6	$8\frac{5}{16}$	$7\frac{1}{2}$	$5\frac{1}{3}$	66, 71
	$3\frac{1}{8}$	$4\frac{2}{3}$	$2\frac{1}{4}$	$1\frac{3}{4}$	$2\frac{1}{2}$	
	$5\frac{3}{4}$	$1\frac{1}{3}$	$6\frac{1}{16}$	$5\frac{3}{4}$	$2\frac{5}{6}$	

Multiply and check the work:

3. $\frac{1}{4} \times 19$ $4\frac{3}{4}$ $\qquad$ $\frac{3}{8} \times 48$ 18 $\qquad$ $\frac{5}{6} \times 25$ $20\frac{5}{6}$ $\qquad$ 87, 89

4. $12 \times 3\frac{1}{2}$ 42 $\qquad$ $10 \times 6\frac{2}{5}$ 64 $\qquad$ $2\frac{1}{4} \times 17$ $38\frac{1}{4}$ $\qquad$ 88, 93

5. $\frac{1}{2} \times \frac{1}{8}$ $\frac{1}{16}$ $\qquad$ $\frac{4}{5} \times \frac{15}{16}$ $\frac{3}{4}$ $\qquad$ $\frac{9}{10} \times \frac{5}{6}$ $\frac{3}{4}$ $\qquad$ 102–105

6. $\frac{3}{4} \times 2\frac{1}{2}$ $1\frac{7}{8}$ $\qquad$ $1\frac{1}{2} \times \frac{2}{3}$ 1 $\qquad$ $2\frac{1}{4} \times 1\frac{3}{5}$ $3\frac{3}{5}$ $\qquad$ 109, 110

Divide and check the work:

7. $7 \div \frac{1}{2}$ 14 $\qquad$ $6 \div \frac{3}{8}$ 16 $\qquad$ $9 \div \frac{2}{3}$ $13\frac{1}{2}$ $\qquad$ 172, 173

8. $\frac{7}{8} \div \frac{1}{2}$ $1\frac{3}{4}$ $\qquad$ $1\frac{4}{5} \div \frac{3}{5}$ 3 $\qquad$ $\frac{7}{8} \div \frac{5}{6}$ $1\frac{1}{20}$ $\qquad$ 174, 175

9. $\frac{3}{8} \div 2$ $\frac{3}{16}$ $\qquad$ $1\frac{1}{4} \div 10$ $\frac{1}{8}$ $\qquad$ $2\frac{5}{8} \div 14$ $\frac{3}{16}$ $\qquad$ 178

10. $\frac{5}{6} \div 1\frac{7}{8}$ $\frac{4}{9}$ $\qquad$ $7\frac{1}{3} \div 1\frac{5}{6}$ 4 $\qquad$ $8 \div 2\frac{2}{3}$ 3 $\qquad$ 180, 181

Find the areas of rectangles with these dimensions:

11. 4 ft. × 6 ft. 3 in. 25 sq.ft. $\qquad$ 3 ft. × 4 ft. 6 in. $13\frac{1}{2}$ sq.ft. $\qquad$ 112, 244

Find the volumes of boxes with these dimensions:

12. 2 in. × 6 in. × $1\frac{1}{2}$ in. 18 cu.in. $\qquad$ 4 ft. × 8 ft. × 16 in. $42\frac{2}{3}$ cu.ft. $\qquad$ 246, 247

Note that these pages correspond with pages 159-160 (half-year tests) and may be used as end-of-year tests. If pupils need extra summer work, refer them to practice pages given after each example.

How Much Have You Learned?

If you miss more than one example in a row, turn to the Practice Pages for that row.

Find the answers: **Practice Pages**

1. 8% of 350 28 45% of 140 63 26% of $280 $72.80 275

Change to decimals:

2. $\frac{3}{5}$ .6 $\frac{7}{8}$ .875 $\frac{11}{25}$ .44 $\frac{9}{20}$ .45 $\frac{3}{100}$ .03 210

Change to decimals correct to the nearest hundredth:

3. $\frac{2}{3}$ .67 $\frac{4}{9}$ .44 $\frac{6}{7}$ .86 $\frac{2}{11}$ .18 $\frac{5}{12}$ .42 211

Multiply and check the work:

4. $\begin{array}{r}3.76\\ 23\\ \hline 86.48\end{array}$ $\begin{array}{r}267\\ .04\\ \hline 10.68\end{array}$ $\begin{array}{r}.09\\ .7\\ \hline .063\end{array}$ $\begin{array}{r}47.8\\ 2.17\\ \hline 103.726\end{array}$ 148–152

Divide. If you continue to have a remainder, find the answer correct to the nearest tenth:

5. $\begin{array}{r}4.5\\ .6\overline{)2.7}\end{array}$ $\begin{array}{r}1.4\\ .25\overline{).35}\end{array}$ $\begin{array}{r}6.8\\ .02\overline{).136}\end{array}$ $\begin{array}{r}5\\ 6.3\overline{)31.5}\end{array}$ 221, 222

6. $\begin{array}{r}.07\\ .2\overline{).014}\end{array}$ $\begin{array}{r}120\\ .07\overline{)8.4}\end{array}$ $\begin{array}{r}400\\ .16\overline{)64}\end{array}$ $\begin{array}{r}.027\\ 5\overline{).135}\end{array}$ 226

7. $\begin{array}{r}37.4\\ 27\overline{)1009.6}\end{array}$ $\begin{array}{r}18.7\\ 6.3\overline{)117.64}\end{array}$ $\begin{array}{r}24.9\\ .36\overline{)8.954}\end{array}$ 226

8. $\begin{array}{r}27\\ 173\overline{)4671}\end{array}$ $\begin{array}{r}148\\ 326\overline{)48248}\end{array}$ $\begin{array}{r}215\\ 288\overline{)61920}\end{array}$ 165–169

Add. Check by going over the work:

9. $\begin{array}{r}18\text{ ft. }7\text{ in.}\\ 13\text{ ft. }9\text{ in.}\\ 14\text{ ft. }1\text{ in.}\\ \hline 46\text{ ft. }5\text{ in.}\end{array}$ $\begin{array}{r}4\text{ bu. }1\text{ pk.}\\ 9\text{ bu. }2\text{ pk.}\\ 7\text{ bu. }3\text{ pk.}\\ \hline 21\text{ bu. }2\text{ pk.}\end{array}$ $\begin{array}{r}7\text{ lb. }12\text{ oz.}\\ 8\text{ lb. }7\text{ oz.}\\ 9\text{ lb. }6\text{ oz.}\\ \hline 25\text{ lb. }9\text{ oz.}\end{array}$ 258, 259

Subtract. Check by going over the work:

10. $\begin{array}{r}15\text{ ft. }2\text{ in.}\\ 6\text{ ft. }8\text{ in.}\\ \hline 8\text{ ft. }6\text{ in.}\end{array}$ $\begin{array}{r}9\text{ qt.}\\ 3\text{ qt. }1\text{ pt.}\\ \hline 5\text{ qt. }1\text{ pt.}\end{array}$ $\begin{array}{r}7\text{ hr.}\\ 2\text{ hr. }34\text{ min.}\\ \hline 4\text{ hr. }26\text{ min.}\end{array}$ 259

Results of tests should be summarized on pupils' progress cards to show weaknesses and improvements.

Provide end-of-year test on year's work.
Use to test readiness for Grade 7.

Are You Ready for the Next Grade?

If you can do the exercises on this page with few or no mistakes, you are ready for the next grade.

1. Give the answers to all the number facts on pages 6, 11, and 22. (1) Then use the number facts on page 6 as multiplication facts and give the answers to them. (2) (1) See answers on these pages; (2) see answers for ex. 1, page 15, on G-13.

Find the answers:

2. $60{,}000 \div 288$ $208\frac{1}{3}$ $5020.4 - 89.7$ 4930.7 $1\frac{3}{4} \times 15$ $26\frac{1}{4}$

3. $3\frac{1}{2} + 1\frac{5}{8} + \frac{3}{4}$ $5\frac{7}{8}$ $22{,}305 \div 27$ $826\frac{1}{9}$ $18 \div \frac{2}{3}$ 27

4. 429×6092 2,613,468 $2\frac{1}{4} + 5\frac{2}{3} + 7\frac{1}{2}$ $15\frac{5}{12}$ $7\frac{3}{4} - 2\frac{1}{2}$ $5\frac{1}{4}$

5. 37.6×8.09 304.184 $.27 + 2.39 + .98$ 3.64 $2\frac{3}{4} \div 1\frac{1}{2}$ $1\frac{5}{6}$

6. $4.088 \div .07$ 58.4 $2400 - 6.73$ 2393.27 $4\frac{1}{8} - 1\frac{3}{4}$ $2\frac{3}{8}$

Tell the number that goes in each space:

7. 12 oz. = $\overset{\frac{3}{4}}{\ldots}$ lb.   6 ft. 8 in. = $\overset{80}{\ldots}$ in.

8. $1\frac{1}{2}$ mi. = $\overset{7920}{\ldots}$ ft.   2 sq. ft. = $\overset{288}{\ldots}$ sq. in.

9. 54 in. = $\overset{1\frac{1}{2}}{\ldots}$ yd.   3 cu. yd. = $\overset{81}{\ldots}$ cu. ft.

10. 3 tons = $\overset{6000}{\ldots}$ lb.   2 hr. 12 min. = $\overset{132}{\ldots}$ min.

Find the answers:

11. Find the average of 3296, 3319, 3285, and 3304. 3301

12. Mr. White drove 133 mi. in $3\frac{1}{2}$ hr. Find the average speed at which Mr. White drove his car. 38 mi.

13. A rectangular lot is 150 ft. wide and 210 ft. long. What is its perimeter? 720 ft. its area? 31,500 sq. ft.

14. At 3 oranges for 10¢, find the cost of $1\frac{1}{2}$ doz. oranges. 60¢

15. One rectangular box is 4 in. × 2 in. × 5 in. and another box is 3 in. × 2 in. × 7 in. Which box is larger in volume? The second How much larger is it? 2 cu. in.

Results of test should be summarized on pupils' progress cards. Refer pupils to specific pages in text, or "More Practice," pages 310-326, if they evidence need for extra summer work.

Present ready-reference page of tables of measures.

Tables of Measures

Linear Measure

12 inches (in.) = 1 foot (ft.)
3 feet = 1 yard (yd.)
$5\frac{1}{2}$ yards or $16\frac{1}{2}$ feet = 1 rod (rd.)
320 rods or 5280 feet = 1 mile (mi.)

Square Measure

144 square inches (sq. in.) = 1 square foot (sq. ft.)
9 square feet = 1 square yard (sq. yd.)
$30\frac{1}{4}$ square yards = 1 square rod (sq. rd.)
43,560 square feet = 1 acre (A.)
160 square rods = 1 acre
640 acres = 1 square mile (sq. mi.)

Cubic Measure

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.)
27 cubic feet = 1 cubic yard (cu. yd.)

Measures of Weight

16 ounces (oz.) = 1 pound (lb.)
2000 pounds = 1 ton (T.)

Measures of Time

60 seconds (sec.) = 1 minute (min.)
60 minutes = 1 hour (hr.)
24 hours = 1 day (da.)
7 days = 1 week (wk.)
About 52 weeks = 1 year (yr.)
12 months or 365 days = 1 year
366 days = 1 leap year
10 years = 1 decade
100 years = 1 century

Liquid Measure

2 cups (c.) = 1 pint (pt.)
2 pints = 1 quart (qt.)
4 quarts = 1 gallon (gal.)

Dry Measure

2 pints = 1 quart (qt.)
8 quarts = 1 peck (pk.)
4 pecks = 1 bushel (bu.)

Provide ready reference of basic addition, subtraction (page 307), multiplication (page 308), and division facts (page 309).

The 100 Addition Facts

$\begin{array}{r}0\\0\\\hline 0\end{array}$	$\begin{array}{r}1\\0\\\hline 1\end{array}$	$\begin{array}{r}2\\0\\\hline 2\end{array}$	$\begin{array}{r}3\\0\\\hline 3\end{array}$	$\begin{array}{r}4\\0\\\hline 4\end{array}$	$\begin{array}{r}5\\0\\\hline 5\end{array}$	$\begin{array}{r}6\\0\\\hline 6\end{array}$	$\begin{array}{r}7\\0\\\hline 7\end{array}$	$\begin{array}{r}8\\0\\\hline 8\end{array}$	$\begin{array}{r}9\\0\\\hline 9\end{array}$
$\begin{array}{r}0\\1\\\hline 1\end{array}$	$\begin{array}{r}1\\1\\\hline 2\end{array}$	$\begin{array}{r}2\\1\\\hline 3\end{array}$	$\begin{array}{r}3\\1\\\hline 4\end{array}$	$\begin{array}{r}4\\1\\\hline 5\end{array}$	$\begin{array}{r}5\\1\\\hline 6\end{array}$	$\begin{array}{r}6\\1\\\hline 7\end{array}$	$\begin{array}{r}7\\1\\\hline 8\end{array}$	$\begin{array}{r}8\\1\\\hline 9\end{array}$	$\begin{array}{r}9\\1\\\hline 10\end{array}$
$\begin{array}{r}0\\2\\\hline 2\end{array}$	$\begin{array}{r}1\\2\\\hline 3\end{array}$	$\begin{array}{r}2\\2\\\hline 4\end{array}$	$\begin{array}{r}3\\2\\\hline 5\end{array}$	$\begin{array}{r}4\\2\\\hline 6\end{array}$	$\begin{array}{r}5\\2\\\hline 7\end{array}$	$\begin{array}{r}6\\2\\\hline 8\end{array}$	$\begin{array}{r}7\\2\\\hline 9\end{array}$	$\begin{array}{r}8\\2\\\hline 10\end{array}$	$\begin{array}{r}9\\2\\\hline 11\end{array}$
$\begin{array}{r}0\\3\\\hline 3\end{array}$	$\begin{array}{r}1\\3\\\hline 4\end{array}$	$\begin{array}{r}2\\3\\\hline 5\end{array}$	$\begin{array}{r}3\\3\\\hline 6\end{array}$	$\begin{array}{r}4\\3\\\hline 7\end{array}$	$\begin{array}{r}5\\3\\\hline 8\end{array}$	$\begin{array}{r}6\\3\\\hline 9\end{array}$	$\begin{array}{r}7\\3\\\hline 10\end{array}$	$\begin{array}{r}8\\3\\\hline 11\end{array}$	$\begin{array}{r}9\\3\\\hline 12\end{array}$
$\begin{array}{r}0\\4\\\hline 4\end{array}$	$\begin{array}{r}1\\4\\\hline 5\end{array}$	$\begin{array}{r}2\\4\\\hline 6\end{array}$	$\begin{array}{r}3\\4\\\hline 7\end{array}$	$\begin{array}{r}4\\4\\\hline 8\end{array}$	$\begin{array}{r}5\\4\\\hline 9\end{array}$	$\begin{array}{r}6\\4\\\hline 10\end{array}$	$\begin{array}{r}7\\4\\\hline 11\end{array}$	$\begin{array}{r}8\\4\\\hline 12\end{array}$	$\begin{array}{r}9\\4\\\hline 13\end{array}$
$\begin{array}{r}0\\5\\\hline 5\end{array}$	$\begin{array}{r}1\\5\\\hline 6\end{array}$	$\begin{array}{r}2\\5\\\hline 7\end{array}$	$\begin{array}{r}3\\5\\\hline 8\end{array}$	$\begin{array}{r}4\\5\\\hline 9\end{array}$	$\begin{array}{r}5\\5\\\hline 10\end{array}$	$\begin{array}{r}6\\5\\\hline 11\end{array}$	$\begin{array}{r}7\\5\\\hline 12\end{array}$	$\begin{array}{r}8\\5\\\hline 13\end{array}$	$\begin{array}{r}9\\5\\\hline 14\end{array}$
$\begin{array}{r}0\\6\\\hline 6\end{array}$	$\begin{array}{r}1\\6\\\hline 7\end{array}$	$\begin{array}{r}2\\6\\\hline 8\end{array}$	$\begin{array}{r}3\\6\\\hline 9\end{array}$	$\begin{array}{r}4\\6\\\hline 10\end{array}$	$\begin{array}{r}5\\6\\\hline 11\end{array}$	$\begin{array}{r}6\\6\\\hline 12\end{array}$	$\begin{array}{r}7\\6\\\hline 13\end{array}$	$\begin{array}{r}8\\6\\\hline 14\end{array}$	$\begin{array}{r}9\\6\\\hline 15\end{array}$
$\begin{array}{r}0\\7\\\hline 7\end{array}$	$\begin{array}{r}1\\7\\\hline 8\end{array}$	$\begin{array}{r}2\\7\\\hline 9\end{array}$	$\begin{array}{r}3\\7\\\hline 10\end{array}$	$\begin{array}{r}4\\7\\\hline 11\end{array}$	$\begin{array}{r}5\\7\\\hline 12\end{array}$	$\begin{array}{r}6\\7\\\hline 13\end{array}$	$\begin{array}{r}7\\7\\\hline 14\end{array}$	$\begin{array}{r}8\\7\\\hline 15\end{array}$	$\begin{array}{r}9\\7\\\hline 16\end{array}$
$\begin{array}{r}0\\8\\\hline 8\end{array}$	$\begin{array}{r}1\\8\\\hline 9\end{array}$	$\begin{array}{r}2\\8\\\hline 10\end{array}$	$\begin{array}{r}3\\8\\\hline 11\end{array}$	$\begin{array}{r}4\\8\\\hline 12\end{array}$	$\begin{array}{r}5\\8\\\hline 13\end{array}$	$\begin{array}{r}6\\8\\\hline 14\end{array}$	$\begin{array}{r}7\\8\\\hline 15\end{array}$	$\begin{array}{r}8\\8\\\hline 16\end{array}$	$\begin{array}{r}9\\8\\\hline 17\end{array}$
$\begin{array}{r}0\\9\\\hline 9\end{array}$	$\begin{array}{r}1\\9\\\hline 10\end{array}$	$\begin{array}{r}2\\9\\\hline 11\end{array}$	$\begin{array}{r}3\\9\\\hline 12\end{array}$	$\begin{array}{r}4\\9\\\hline 13\end{array}$	$\begin{array}{r}5\\9\\\hline 14\end{array}$	$\begin{array}{r}6\\9\\\hline 15\end{array}$	$\begin{array}{r}7\\9\\\hline 16\end{array}$	$\begin{array}{r}8\\9\\\hline 17\end{array}$	$\begin{array}{r}9\\9\\\hline 18\end{array}$

Facts are listed in sequential order so that pupils may see relationships which exist between them. Be sure to point out these relationships.

The 100 Subtraction Facts

$\begin{array}{r}0\\0\\\hline 0\end{array}$	$\begin{array}{r}1\\0\\\hline 1\end{array}$	$\begin{array}{r}2\\0\\\hline 2\end{array}$	$\begin{array}{r}3\\0\\\hline 3\end{array}$	$\begin{array}{r}4\\0\\\hline 4\end{array}$	$\begin{array}{r}5\\0\\\hline 5\end{array}$	$\begin{array}{r}6\\0\\\hline 6\end{array}$	$\begin{array}{r}7\\0\\\hline 7\end{array}$	$\begin{array}{r}8\\0\\\hline 8\end{array}$	$\begin{array}{r}9\\0\\\hline 9\end{array}$
$\begin{array}{r}1\\1\\\hline 0\end{array}$	$\begin{array}{r}2\\1\\\hline 1\end{array}$	$\begin{array}{r}3\\1\\\hline 2\end{array}$	$\begin{array}{r}4\\1\\\hline 3\end{array}$	$\begin{array}{r}5\\1\\\hline 4\end{array}$	$\begin{array}{r}6\\1\\\hline 5\end{array}$	$\begin{array}{r}7\\1\\\hline 6\end{array}$	$\begin{array}{r}8\\1\\\hline 7\end{array}$	$\begin{array}{r}9\\1\\\hline 8\end{array}$	$\begin{array}{r}10\\1\\\hline 9\end{array}$
$\begin{array}{r}2\\2\\\hline 0\end{array}$	$\begin{array}{r}3\\2\\\hline 1\end{array}$	$\begin{array}{r}4\\2\\\hline 2\end{array}$	$\begin{array}{r}5\\2\\\hline 3\end{array}$	$\begin{array}{r}6\\2\\\hline 4\end{array}$	$\begin{array}{r}7\\2\\\hline 5\end{array}$	$\begin{array}{r}8\\2\\\hline 6\end{array}$	$\begin{array}{r}9\\2\\\hline 7\end{array}$	$\begin{array}{r}10\\2\\\hline 8\end{array}$	$\begin{array}{r}11\\2\\\hline 9\end{array}$
$\begin{array}{r}3\\3\\\hline 0\end{array}$	$\begin{array}{r}4\\3\\\hline 1\end{array}$	$\begin{array}{r}5\\3\\\hline 2\end{array}$	$\begin{array}{r}6\\3\\\hline 3\end{array}$	$\begin{array}{r}7\\3\\\hline 4\end{array}$	$\begin{array}{r}8\\3\\\hline 5\end{array}$	$\begin{array}{r}9\\3\\\hline 6\end{array}$	$\begin{array}{r}10\\3\\\hline 7\end{array}$	$\begin{array}{r}11\\3\\\hline 8\end{array}$	$\begin{array}{r}12\\3\\\hline 9\end{array}$
$\begin{array}{r}4\\4\\\hline 0\end{array}$	$\begin{array}{r}5\\4\\\hline 1\end{array}$	$\begin{array}{r}6\\4\\\hline 2\end{array}$	$\begin{array}{r}7\\4\\\hline 3\end{array}$	$\begin{array}{r}8\\4\\\hline 4\end{array}$	$\begin{array}{r}9\\4\\\hline 5\end{array}$	$\begin{array}{r}10\\4\\\hline 6\end{array}$	$\begin{array}{r}11\\4\\\hline 7\end{array}$	$\begin{array}{r}12\\4\\\hline 8\end{array}$	$\begin{array}{r}13\\4\\\hline 9\end{array}$
$\begin{array}{r}5\\5\\\hline 0\end{array}$	$\begin{array}{r}6\\5\\\hline 1\end{array}$	$\begin{array}{r}7\\5\\\hline 2\end{array}$	$\begin{array}{r}8\\5\\\hline 3\end{array}$	$\begin{array}{r}9\\5\\\hline 4\end{array}$	$\begin{array}{r}10\\5\\\hline 5\end{array}$	$\begin{array}{r}11\\5\\\hline 6\end{array}$	$\begin{array}{r}12\\5\\\hline 7\end{array}$	$\begin{array}{r}13\\5\\\hline 8\end{array}$	$\begin{array}{r}14\\5\\\hline 9\end{array}$
$\begin{array}{r}6\\6\\\hline 0\end{array}$	$\begin{array}{r}7\\6\\\hline 1\end{array}$	$\begin{array}{r}8\\6\\\hline 2\end{array}$	$\begin{array}{r}9\\6\\\hline 3\end{array}$	$\begin{array}{r}10\\6\\\hline 4\end{array}$	$\begin{array}{r}11\\6\\\hline 5\end{array}$	$\begin{array}{r}12\\6\\\hline 6\end{array}$	$\begin{array}{r}13\\6\\\hline 7\end{array}$	$\begin{array}{r}14\\6\\\hline 8\end{array}$	$\begin{array}{r}15\\6\\\hline 9\end{array}$
$\begin{array}{r}7\\7\\\hline 0\end{array}$	$\begin{array}{r}8\\7\\\hline 1\end{array}$	$\begin{array}{r}9\\7\\\hline 2\end{array}$	$\begin{array}{r}10\\7\\\hline 3\end{array}$	$\begin{array}{r}11\\7\\\hline 4\end{array}$	$\begin{array}{r}12\\7\\\hline 5\end{array}$	$\begin{array}{r}13\\7\\\hline 6\end{array}$	$\begin{array}{r}14\\7\\\hline 7\end{array}$	$\begin{array}{r}15\\7\\\hline 8\end{array}$	$\begin{array}{r}16\\7\\\hline 9\end{array}$
$\begin{array}{r}8\\8\\\hline 0\end{array}$	$\begin{array}{r}9\\8\\\hline 1\end{array}$	$\begin{array}{r}10\\8\\\hline 2\end{array}$	$\begin{array}{r}11\\8\\\hline 3\end{array}$	$\begin{array}{r}12\\8\\\hline 4\end{array}$	$\begin{array}{r}13\\8\\\hline 5\end{array}$	$\begin{array}{r}14\\8\\\hline 6\end{array}$	$\begin{array}{r}15\\8\\\hline 7\end{array}$	$\begin{array}{r}16\\8\\\hline 8\end{array}$	$\begin{array}{r}17\\8\\\hline 9\end{array}$
$\begin{array}{r}9\\9\\\hline 0\end{array}$	$\begin{array}{r}10\\9\\\hline 1\end{array}$	$\begin{array}{r}11\\9\\\hline 2\end{array}$	$\begin{array}{r}12\\9\\\hline 3\end{array}$	$\begin{array}{r}13\\9\\\hline 4\end{array}$	$\begin{array}{r}14\\9\\\hline 5\end{array}$	$\begin{array}{r}15\\9\\\hline 6\end{array}$	$\begin{array}{r}16\\9\\\hline 7\end{array}$	$\begin{array}{r}17\\9\\\hline 8\end{array}$	$\begin{array}{r}18\\9\\\hline 9\end{array}$

The 100 Multiplication Facts

$\begin{array}{r}0\\ \underline{0}\\ 0\end{array}$	$\begin{array}{r}1\\ \underline{0}\\ 0\end{array}$	$\begin{array}{r}2\\ \underline{0}\\ 0\end{array}$	$\begin{array}{r}3\\ \underline{0}\\ 0\end{array}$	$\begin{array}{r}4\\ \underline{0}\\ 0\end{array}$	$\begin{array}{r}5\\ \underline{0}\\ 0\end{array}$	$\begin{array}{r}6\\ \underline{0}\\ 0\end{array}$	$\begin{array}{r}7\\ \underline{0}\\ 0\end{array}$	$\begin{array}{r}8\\ \underline{0}\\ 0\end{array}$	$\begin{array}{r}9\\ \underline{0}\\ 0\end{array}$
$\begin{array}{r}0\\ \underline{1}\\ 0\end{array}$	$\begin{array}{r}1\\ \underline{1}\\ 1\end{array}$	$\begin{array}{r}2\\ \underline{1}\\ 2\end{array}$	$\begin{array}{r}3\\ \underline{1}\\ 3\end{array}$	$\begin{array}{r}4\\ \underline{1}\\ 4\end{array}$	$\begin{array}{r}5\\ \underline{1}\\ 5\end{array}$	$\begin{array}{r}6\\ \underline{1}\\ 6\end{array}$	$\begin{array}{r}7\\ \underline{1}\\ 7\end{array}$	$\begin{array}{r}8\\ \underline{1}\\ 8\end{array}$	$\begin{array}{r}9\\ \underline{1}\\ 9\end{array}$
$\begin{array}{r}0\\ \underline{2}\\ 0\end{array}$	$\begin{array}{r}1\\ \underline{2}\\ 2\end{array}$	$\begin{array}{r}2\\ \underline{2}\\ 4\end{array}$	$\begin{array}{r}3\\ \underline{2}\\ 6\end{array}$	$\begin{array}{r}4\\ \underline{2}\\ 8\end{array}$	$\begin{array}{r}5\\ \underline{2}\\ 10\end{array}$	$\begin{array}{r}6\\ \underline{2}\\ 12\end{array}$	$\begin{array}{r}7\\ \underline{2}\\ 14\end{array}$	$\begin{array}{r}8\\ \underline{2}\\ 16\end{array}$	$\begin{array}{r}9\\ \underline{2}\\ 18\end{array}$
$\begin{array}{r}0\\ \underline{3}\\ 0\end{array}$	$\begin{array}{r}1\\ \underline{3}\\ 3\end{array}$	$\begin{array}{r}2\\ \underline{3}\\ 6\end{array}$	$\begin{array}{r}3\\ \underline{3}\\ 9\end{array}$	$\begin{array}{r}4\\ \underline{3}\\ 12\end{array}$	$\begin{array}{r}5\\ \underline{3}\\ 15\end{array}$	$\begin{array}{r}6\\ \underline{3}\\ 18\end{array}$	$\begin{array}{r}7\\ \underline{3}\\ 21\end{array}$	$\begin{array}{r}8\\ \underline{3}\\ 24\end{array}$	$\begin{array}{r}9\\ \underline{3}\\ 27\end{array}$
$\begin{array}{r}0\\ \underline{4}\\ 0\end{array}$	$\begin{array}{r}1\\ \underline{4}\\ 4\end{array}$	$\begin{array}{r}2\\ \underline{4}\\ 8\end{array}$	$\begin{array}{r}3\\ \underline{4}\\ 12\end{array}$	$\begin{array}{r}4\\ \underline{4}\\ 16\end{array}$	$\begin{array}{r}5\\ \underline{4}\\ 20\end{array}$	$\begin{array}{r}6\\ \underline{4}\\ 24\end{array}$	$\begin{array}{r}7\\ \underline{4}\\ 28\end{array}$	$\begin{array}{r}8\\ \underline{4}\\ 32\end{array}$	$\begin{array}{r}9\\ \underline{4}\\ 36\end{array}$
$\begin{array}{r}0\\ \underline{5}\\ 0\end{array}$	$\begin{array}{r}1\\ \underline{5}\\ 5\end{array}$	$\begin{array}{r}2\\ \underline{5}\\ 10\end{array}$	$\begin{array}{r}3\\ \underline{5}\\ 15\end{array}$	$\begin{array}{r}4\\ \underline{5}\\ 20\end{array}$	$\begin{array}{r}5\\ \underline{5}\\ 25\end{array}$	$\begin{array}{r}6\\ \underline{5}\\ 30\end{array}$	$\begin{array}{r}7\\ \underline{5}\\ 35\end{array}$	$\begin{array}{r}8\\ \underline{5}\\ 40\end{array}$	$\begin{array}{r}9\\ \underline{5}\\ 45\end{array}$
$\begin{array}{r}0\\ \underline{6}\\ 0\end{array}$	$\begin{array}{r}1\\ \underline{6}\\ 6\end{array}$	$\begin{array}{r}2\\ \underline{6}\\ 12\end{array}$	$\begin{array}{r}3\\ \underline{6}\\ 18\end{array}$	$\begin{array}{r}4\\ \underline{6}\\ 24\end{array}$	$\begin{array}{r}5\\ \underline{6}\\ 30\end{array}$	$\begin{array}{r}6\\ \underline{6}\\ 36\end{array}$	$\begin{array}{r}7\\ \underline{6}\\ 42\end{array}$	$\begin{array}{r}8\\ \underline{6}\\ 48\end{array}$	$\begin{array}{r}9\\ \underline{6}\\ 54\end{array}$
$\begin{array}{r}0\\ \underline{7}\\ 0\end{array}$	$\begin{array}{r}1\\ \underline{7}\\ 7\end{array}$	$\begin{array}{r}2\\ \underline{7}\\ 14\end{array}$	$\begin{array}{r}3\\ \underline{7}\\ 21\end{array}$	$\begin{array}{r}4\\ \underline{7}\\ 28\end{array}$	$\begin{array}{r}5\\ \underline{7}\\ 35\end{array}$	$\begin{array}{r}6\\ \underline{7}\\ 42\end{array}$	$\begin{array}{r}7\\ \underline{7}\\ 49\end{array}$	$\begin{array}{r}8\\ \underline{7}\\ 56\end{array}$	$\begin{array}{r}9\\ \underline{7}\\ 63\end{array}$
$\begin{array}{r}0\\ \underline{8}\\ 0\end{array}$	$\begin{array}{r}1\\ \underline{8}\\ 8\end{array}$	$\begin{array}{r}2\\ \underline{8}\\ 16\end{array}$	$\begin{array}{r}3\\ \underline{8}\\ 24\end{array}$	$\begin{array}{r}4\\ \underline{8}\\ 32\end{array}$	$\begin{array}{r}5\\ \underline{8}\\ 40\end{array}$	$\begin{array}{r}6\\ \underline{8}\\ 48\end{array}$	$\begin{array}{r}7\\ \underline{8}\\ 56\end{array}$	$\begin{array}{r}8\\ \underline{8}\\ 64\end{array}$	$\begin{array}{r}9\\ \underline{8}\\ 72\end{array}$
$\begin{array}{r}0\\ \underline{9}\\ 0\end{array}$	$\begin{array}{r}1\\ \underline{9}\\ 9\end{array}$	$\begin{array}{r}2\\ \underline{9}\\ 18\end{array}$	$\begin{array}{r}3\\ \underline{9}\\ 27\end{array}$	$\begin{array}{r}4\\ \underline{9}\\ 36\end{array}$	$\begin{array}{r}5\\ \underline{9}\\ 45\end{array}$	$\begin{array}{r}6\\ \underline{9}\\ 54\end{array}$	$\begin{array}{r}7\\ \underline{9}\\ 63\end{array}$	$\begin{array}{r}8\\ \underline{9}\\ 72\end{array}$	$\begin{array}{r}9\\ \underline{9}\\ 81\end{array}$

The 90 Division Facts

$$\begin{array}{r}1\\1\overline{)1}\end{array}\quad\begin{array}{r}2\\1\overline{)2}\end{array}\quad\begin{array}{r}3\\1\overline{)3}\end{array}\quad\begin{array}{r}4\\1\overline{)4}\end{array}\quad\begin{array}{r}5\\1\overline{)5}\end{array}\quad\begin{array}{r}6\\1\overline{)6}\end{array}\quad\begin{array}{r}7\\1\overline{)7}\end{array}\quad\begin{array}{r}8\\1\overline{)8}\end{array}\quad\begin{array}{r}9\\1\overline{)9}\end{array}$$

$$\begin{array}{r}1\\2\overline{)2}\end{array}\quad\begin{array}{r}2\\2\overline{)4}\end{array}\quad\begin{array}{r}3\\2\overline{)6}\end{array}\quad\begin{array}{r}4\\2\overline{)8}\end{array}\quad\begin{array}{r}5\\2\overline{)10}\end{array}\quad\begin{array}{r}6\\2\overline{)12}\end{array}\quad\begin{array}{r}7\\2\overline{)14}\end{array}\quad\begin{array}{r}8\\2\overline{)16}\end{array}\quad\begin{array}{r}9\\2\overline{)18}\end{array}$$

$$\begin{array}{r}1\\3\overline{)3}\end{array}\quad\begin{array}{r}2\\3\overline{)6}\end{array}\quad\begin{array}{r}3\\3\overline{)9}\end{array}\quad\begin{array}{r}4\\3\overline{)12}\end{array}\quad\begin{array}{r}5\\3\overline{)15}\end{array}\quad\begin{array}{r}6\\3\overline{)18}\end{array}\quad\begin{array}{r}7\\3\overline{)21}\end{array}\quad\begin{array}{r}8\\3\overline{)24}\end{array}\quad\begin{array}{r}9\\3\overline{)27}\end{array}$$

$$\begin{array}{r}1\\4\overline{)4}\end{array}\quad\begin{array}{r}2\\4\overline{)8}\end{array}\quad\begin{array}{r}3\\4\overline{)12}\end{array}\quad\begin{array}{r}4\\4\overline{)16}\end{array}\quad\begin{array}{r}5\\4\overline{)20}\end{array}\quad\begin{array}{r}6\\4\overline{)24}\end{array}\quad\begin{array}{r}7\\4\overline{)28}\end{array}\quad\begin{array}{r}8\\4\overline{)32}\end{array}\quad\begin{array}{r}9\\4\overline{)36}\end{array}$$

$$\begin{array}{r}1\\5\overline{)5}\end{array}\quad\begin{array}{r}2\\5\overline{)10}\end{array}\quad\begin{array}{r}3\\5\overline{)15}\end{array}\quad\begin{array}{r}4\\5\overline{)20}\end{array}\quad\begin{array}{r}5\\5\overline{)25}\end{array}\quad\begin{array}{r}6\\5\overline{)30}\end{array}\quad\begin{array}{r}7\\5\overline{)35}\end{array}\quad\begin{array}{r}8\\5\overline{)40}\end{array}\quad\begin{array}{r}9\\5\overline{)45}\end{array}$$

$$\begin{array}{r}1\\6\overline{)6}\end{array}\quad\begin{array}{r}2\\6\overline{)12}\end{array}\quad\begin{array}{r}3\\6\overline{)18}\end{array}\quad\begin{array}{r}4\\6\overline{)24}\end{array}\quad\begin{array}{r}5\\6\overline{)30}\end{array}\quad\begin{array}{r}6\\6\overline{)36}\end{array}\quad\begin{array}{r}7\\6\overline{)42}\end{array}\quad\begin{array}{r}8\\6\overline{)48}\end{array}\quad\begin{array}{r}9\\6\overline{)54}\end{array}$$

$$\begin{array}{r}1\\7\overline{)7}\end{array}\quad\begin{array}{r}2\\7\overline{)14}\end{array}\quad\begin{array}{r}3\\7\overline{)21}\end{array}\quad\begin{array}{r}4\\7\overline{)28}\end{array}\quad\begin{array}{r}5\\7\overline{)35}\end{array}\quad\begin{array}{r}6\\7\overline{)42}\end{array}\quad\begin{array}{r}7\\7\overline{)49}\end{array}\quad\begin{array}{r}8\\7\overline{)56}\end{array}\quad\begin{array}{r}9\\7\overline{)63}\end{array}$$

$$\begin{array}{r}1\\8\overline{)8}\end{array}\quad\begin{array}{r}2\\8\overline{)16}\end{array}\quad\begin{array}{r}3\\8\overline{)24}\end{array}\quad\begin{array}{r}4\\8\overline{)32}\end{array}\quad\begin{array}{r}5\\8\overline{)40}\end{array}\quad\begin{array}{r}6\\8\overline{)48}\end{array}\quad\begin{array}{r}7\\8\overline{)56}\end{array}\quad\begin{array}{r}8\\8\overline{)64}\end{array}\quad\begin{array}{r}9\\8\overline{)72}\end{array}$$

$$\begin{array}{r}1\\9\overline{)9}\end{array}\quad\begin{array}{r}2\\9\overline{)18}\end{array}\quad\begin{array}{r}3\\9\overline{)27}\end{array}\quad\begin{array}{r}4\\9\overline{)36}\end{array}\quad\begin{array}{r}5\\9\overline{)45}\end{array}\quad\begin{array}{r}6\\9\overline{)54}\end{array}\quad\begin{array}{r}7\\9\overline{)63}\end{array}\quad\begin{array}{r}8\\9\overline{)72}\end{array}\quad\begin{array}{r}9\\9\overline{)81}\end{array}$$

$$\begin{array}{r}0\\1\overline{)0}\end{array}\quad\begin{array}{r}0\\2\overline{)0}\end{array}\quad\begin{array}{r}0\\3\overline{)0}\end{array}\quad\begin{array}{r}0\\4\overline{)0}\end{array}\quad\begin{array}{r}0\\5\overline{)0}\end{array}\quad\begin{array}{r}0\\6\overline{)0}\end{array}\quad\begin{array}{r}0\\7\overline{)0}\end{array}\quad\begin{array}{r}0\\8\overline{)0}\end{array}\quad\begin{array}{r}0\\9\overline{)0}\end{array}$$

Pages 310-326 provide practice material in all skills reviewed or taught in Grade 6.

More Practice

①

1.	62	327	658	578	947	263	1773
	79	409	356	853	256	1984	769
	18	126	622	895	998	643	204
	25	543	174	427	296	819	826
	+46	+188	+429	+247	+509	+2075	+1718
	230	1593	2239	3000	3006	5784	5290
2.	27	265	501	337	185	7889	8424
	19	547	734	384	393	324	897
	83	596	498	433	235	419	1708
	60	285	161	675	869	2074	765
	+56	+639	+702	+654	+318	+1155	+ 326
	245	2332	2596	2483	2000	11,861	12,120

②

3. 87 − 5 82   36 − 6 30   49 − 3 46   68 − 4 64   24 − 4 20

4. 60 − 6 54   90 − 5 85   30 − 7 23   70 − 9 61   40 − 8 32

5. 52 − 9 43   71 − 4 67   35 − 8 27   94 − 6 88   63 − 9 54

6.	91	679	145	393	800	1785	2400
	−73	−337	−92	−357	−463	−927	−1252
	18	342	53	36	337	858	1148
7.	58	471	126	600	332	5304	1222
	−46	−148	−79	−321	−257	−2388	−624
	12	323	47	279	75	2916	598
8.	60	369	155	548	200	6233	1648
	−54	−124	−79	−359	−168	−1564	−652
	6	245	76	189	32	4669	996
9.	82	927	173	700	738	1000	9796
	−18	−198	−88	−176	−563	−814	−9687
	64	729	85	524	175	186	109

③

10. 18 × 72 1296   37 × 85 3145   92 × 94 8648   71 × 97 6887   51 × 29 1479

11. 15 × 64 960   24 × 73 1752   20 × 68 1360   56 × 83 4648   94 × 90 8460

12. 16 × 59 944   48 × 84 4032   60 × 76 4560   35 × 71 2485   73 × 43 3139

13. 19 × 37 703   82 × 65 5330   83 × 90 7470   47 × 62 2914   69 × 84 5796

These pages are correlated with ones throughout the text. Use for individual pupil assistance, review and reinforcement of processes, reteaching, and so on.

④

1. 80 × 93 7440 650 × 546 354,900 480 × 641 307,680 609 × 923 562,107

2. 40 × 50 2000 380 × 752 285,760 107 × 435 46,545 125 × 150 18,750

3. 78 × 80 6240 125 × 700 87,500 705 × 812 572,460 105 × 309 32,445

4. 60 × 81 4860 209 × 478 99,902 304 × 643 195,472 297 × 600 178,200

5. 43 × 70 3010 340 × 289 98,260 429 × 500 214,500 293 × 701 205,393

⑤

6. $\overset{1R2}{4\overline{)6}}$ $\overset{8R2}{3\overline{)26}}$ $\overset{4R1}{7\overline{)29}}$ $\overset{4R5}{8\overline{)37}}$ $\overset{3R4}{5\overline{)19}}$ $\overset{8R7}{9\overline{)79}}$ $\overset{6R3}{6\overline{)39}}$

7. $\overset{0R4}{7\overline{)4}}$ $\overset{8R4}{5\overline{)44}}$ $\overset{2R3}{9\overline{)21}}$ $\overset{7R5}{6\overline{)47}}$ $\overset{6R7}{8\overline{)55}}$ $\overset{7R3}{4\overline{)31}}$ $\overset{4R3}{7\overline{)31}}$

8. $\overset{2R1}{2\overline{)5}}$ $\overset{2R3}{8\overline{)19}}$ $\overset{5R3}{5\overline{)28}}$ $\overset{6R6}{7\overline{)48}}$ $\overset{6R2}{3\overline{)20}}$ $\overset{8R2}{6\overline{)50}}$ $\overset{5R4}{9\overline{)49}}$

9. $\overset{0R5}{6\overline{)5}}$ $\overset{7R3}{7\overline{)52}}$ $\overset{8R4}{6\overline{)52}}$ $\overset{3R3}{9\overline{)30}}$ $\overset{7R3}{5\overline{)38}}$ $\overset{3R7}{8\overline{)31}}$ $\overset{9R1}{2\overline{)19}}$

10. $\overset{1R1}{3\overline{)4}}$ $\overset{7R6}{8\overline{)62}}$ $\overset{8R2}{5\overline{)42}}$ $\overset{9R1}{4\overline{)37}}$ $\overset{3R5}{6\overline{)23}}$ $\overset{6R6}{9\overline{)60}}$ $\overset{9R5}{7\overline{)68}}$

11. $\overset{0R3}{5\overline{)3}}$ $\overset{9R5}{6\overline{)59}}$ $\overset{5R6}{9\overline{)51}}$ $\overset{6R1}{8\overline{)49}}$ $\overset{8R4}{7\overline{)60}}$ $\overset{5R1}{5\overline{)26}}$ $\overset{3R3}{8\overline{)27}}$

12. $\overset{2R1}{3\overline{)7}}$ $\overset{9R4}{5\overline{)49}}$ $\overset{2R5}{9\overline{)23}}$ $\overset{2R3}{7\overline{)17}}$ $\overset{4R5}{6\overline{)29}}$ $\overset{4R3}{8\overline{)35}}$ $\overset{3R1}{9\overline{)28}}$

13. $\overset{4R1}{2\overline{)9}}$ $\overset{8R5}{8\overline{)69}}$ $\overset{5R5}{6\overline{)35}}$ $\overset{9R2}{3\overline{)29}}$ $\overset{4R8}{9\overline{)44}}$ $\overset{3R4}{7\overline{)25}}$ $\overset{9R1}{6\overline{)55}}$

⑥

14. $\overset{368}{2\overline{)736}}$ $\overset{105}{9\overline{)945}}$ $\overset{654}{7\overline{)4578}}$ $\overset{853}{5\overline{)4265}}$ $\overset{5367R4}{8\overline{)42940}}$

15. $\overset{269}{3\overline{)807}}$ $\overset{163R5}{6\overline{)983}}$ $\overset{907R3}{4\overline{)3631}}$ $\overset{685}{9\overline{)6165}}$ $\overset{4582}{6\overline{)27492}}$

16. $\overset{189}{4\overline{)756}}$ $\overset{124R7}{8\overline{)999}}$ $\overset{640R4}{5\overline{)3204}}$ $\overset{871R3}{7\overline{)6100}}$ $\overset{1985}{8\overline{)15880}}$

17. $\overset{197R2}{5\overline{)987}}$ $\overset{409R1}{2\overline{)819}}$ $\overset{389R4}{7\overline{)2727}}$ $\overset{457}{3\overline{)1371}}$ $\overset{5097R4}{6\overline{)30586}}$

18. $\overset{138R2}{3\overline{)416}}$ $\overset{148}{5\overline{)740}}$ $\overset{934}{9\overline{)8406}}$ $\overset{509}{7\overline{)3563}}$ $\overset{6418}{4\overline{)25672}}$

19. $\overset{287}{2\overline{)574}}$ $\overset{69R2}{3\overline{)209}}$ $\overset{709}{5\overline{)3545}}$ $\overset{819}{6\overline{)4914}}$ $\overset{3070R2}{7\overline{)21492}}$

More Practice

⑦

1.	$\overset{25\frac{1}{3}}{3\overline{)76}}$	$\overset{198\frac{1}{4}}{4\overline{)793}}$	$\overset{846}{5\overline{)4230}}$	$\overset{750}{8\overline{)6000}}$	$\overset{935\frac{5}{7}}{7\overline{)6550}}$
2.	$\overset{32\frac{1}{2}}{2\overline{)65}}$	$\overset{218\frac{1}{3}}{3\overline{)655}}$	$\overset{728}{6\overline{)4368}}$	$\overset{563}{9\overline{)5067}}$	$\overset{769}{5\overline{)3845}}$
3.	$\overset{17\frac{3}{5}}{5\overline{)88}}$	$\overset{292\frac{1}{2}}{2\overline{)585}}$	$\overset{874}{7\overline{)6118}}$	$\overset{593\frac{4}{5}}{5\overline{)2969}}$	$\overset{608\frac{7}{8}}{8\overline{)4871}}$
4.	$\overset{23\frac{3}{4}}{4\overline{)95}}$	$\overset{149\frac{1}{6}}{6\overline{)895}}$	$\overset{497}{8\overline{)3976}}$	$\overset{692}{7\overline{)4844}}$	$\overset{807\frac{5}{9}}{9\overline{)7268}}$
5.	$\overset{29\frac{2}{3}}{3\overline{)89}}$	$\overset{152\frac{2}{5}}{5\overline{)762}}$	$\overset{429}{9\overline{)3861}}$	$\overset{563\frac{5}{6}}{6\overline{)3383}}$	$\overset{268}{7\overline{)1876}}$
6.	$\overset{13\frac{4}{5}}{5\overline{)69}}$	$\overset{94}{9\overline{)846}}$	$\overset{508}{4\overline{)2032}}$	$\overset{558}{7\overline{)3906}}$	$\overset{273\frac{5}{6}}{6\overline{)1643}}$

⑧

7.	$\overset{64}{43\overline{)2752}}$	$\overset{72}{32\overline{)2304}}$	$\overset{217}{44\overline{)9548}}$	$\overset{354}{65\overline{)23010}}$
8.	$\overset{72}{33\overline{)2376}}$	$\overset{86}{41\overline{)3526}}$	$\overset{91\text{ R37}}{63\overline{)5770}}$	$\overset{845}{53\overline{)44785}}$
9.	$\overset{43}{45\overline{)1935}}$	$\overset{465}{21\overline{)9765}}$	$\overset{26\text{ R13}}{75\overline{)1963}}$	$\overset{865\text{ R4}}{31\overline{)26819}}$
10.	$\overset{54\text{ R1}}{22\overline{)1189}}$	$\overset{74\text{ R15}}{52\overline{)3863}}$	$\overset{71}{32\overline{)2272}}$	$\overset{423}{54\overline{)22842}}$
11.	$\overset{63}{41\overline{)2583}}$	$\overset{35}{65\overline{)2275}}$	$\overset{65}{42\overline{)2730}}$	$\overset{524}{33\overline{)17292}}$
12.	$\overset{57}{94\overline{)5358}}$	$\overset{37}{41\overline{)1517}}$	$\overset{42}{85\overline{)3570}}$	$\overset{816}{43\overline{)35088}}$

⑨

13.	$\overset{292\text{ R29}}{31\overline{)9081}}$	$\overset{44}{24\overline{)1056}}$	$\overset{49}{25\overline{)1225}}$	$\overset{876}{23\overline{)20148}}$
14.	$\overset{184\text{ R12}}{22\overline{)4060}}$	$\overset{57\text{ R18}}{21\overline{)1215}}$	$\overset{81\text{ R31}}{34\overline{)2785}}$	$\overset{677}{25\overline{)16925}}$
15.	$\overset{57\text{ R19}}{32\overline{)1843}}$	$\overset{57\text{ R11}}{45\overline{)2576}}$	$\overset{97}{24\overline{)2328}}$	$\overset{563}{65\overline{)36595}}$
16.	$\overset{57}{55\overline{)3135}}$	$\overset{187}{23\overline{)4301}}$	$\overset{78\text{ R20}}{21\overline{)1658}}$	$\overset{837\text{ R9}}{45\overline{)37674}}$
17.	$\overset{91}{34\overline{)3094}}$	$\overset{78\text{ R15}}{25\overline{)1965}}$	$\overset{57\text{ R7}}{22\overline{)1261}}$	$\overset{767\text{ R7}}{34\overline{)26085}}$
18.	$\overset{75}{25\overline{)1875}}$	$\overset{63\text{ R19}}{34\overline{)2161}}$	$\overset{47}{23\overline{)1081}}$	$\overset{577}{25\overline{)14425}}$

⑩

1.	$\begin{array}{r}29\text{R}23\\48\overline{)1415}\end{array}$	$\begin{array}{r}99\text{R}13\\29\overline{)2884}\end{array}$	$\begin{array}{r}65\text{R}24\\37\overline{)2429}\end{array}$	$\begin{array}{r}277\text{R}28\\76\overline{)21080}\end{array}$
2.	$\begin{array}{r}245\text{R}16\\27\overline{)6631}\end{array}$	$\begin{array}{r}63\text{R}26\\49\overline{)3113}\end{array}$	$\begin{array}{r}67\text{R}19\\88\overline{)5915}\end{array}$	$\begin{array}{r}685\text{R}11\\19\overline{)13026}\end{array}$
3.	$\begin{array}{r}47\text{R}28\\46\overline{)2190}\end{array}$	$\begin{array}{r}62\text{R}15\\39\overline{)2433}\end{array}$	$\begin{array}{r}57\text{R}28\\67\overline{)3847}\end{array}$	$\begin{array}{r}335\text{R}18\\59\overline{)19783}\end{array}$
4.	$\begin{array}{r}94\text{R}62\\86\overline{)8146}\end{array}$	$\begin{array}{r}45\text{R}24\\58\overline{)2634}\end{array}$	$\begin{array}{r}36\text{R}24\\36\overline{)1320}\end{array}$	$\begin{array}{r}297\text{R}29\\96\overline{)28541}\end{array}$
5.	$\begin{array}{r}75\text{R}19\\47\overline{)3544}\end{array}$	$\begin{array}{r}67\text{R}43\\66\overline{)4465}\end{array}$	$\begin{array}{r}67\text{R}31\\87\overline{)5860}\end{array}$	$\begin{array}{r}743\text{R}23\\89\overline{)66150}\end{array}$
6.	$\begin{array}{r}75\text{R}10\\28\overline{)2110}\end{array}$	$\begin{array}{r}218\text{R}26\\29\overline{)6348}\end{array}$	$\begin{array}{r}56\text{R}42\\56\overline{)3178}\end{array}$	$\begin{array}{r}423\text{R}10\\38\overline{)16084}\end{array}$
7.	$\begin{array}{r}56\text{R}11\\69\overline{)3875}\end{array}$	$\begin{array}{r}235\text{R}21\\26\overline{)6131}\end{array}$	$\begin{array}{r}18\text{R}40\\68\overline{)1264}\end{array}$	$\begin{array}{r}459\text{R}27\\78\overline{)35829}\end{array}$
8.	$\begin{array}{r}73\text{R}10\\49\overline{)3587}\end{array}$	$\begin{array}{r}73\text{R}9\\77\overline{)5630}\end{array}$	$\begin{array}{r}53\text{R}6\\79\overline{)4193}\end{array}$	$\begin{array}{r}864\text{R}14\\19\overline{)16430}\end{array}$

⑪

9.	$\begin{array}{r}42\\57\overline{)2394}\end{array}$	$\begin{array}{r}36\\59\overline{)2124}\end{array}$	$\begin{array}{r}82\\28\overline{)2296}\end{array}$	$\begin{array}{r}426\text{R}7\\46\overline{)19603}\end{array}$
10.	$\begin{array}{r}91\text{R}10\\27\overline{)2467}\end{array}$	$\begin{array}{r}42\\38\overline{)1596}\end{array}$	$\begin{array}{r}94\\47\overline{)4418}\end{array}$	$\begin{array}{r}596\\28\overline{)16688}\end{array}$
11.	$\begin{array}{r}92\\39\overline{)3588}\end{array}$	$\begin{array}{r}65\\36\overline{)2340}\end{array}$	$\begin{array}{r}72\\29\overline{)2088}\end{array}$	$\begin{array}{r}743\text{R}8\\56\overline{)41616}\end{array}$
12.	$\begin{array}{r}75\\26\overline{)1950}\end{array}$	$\begin{array}{r}83\\48\overline{)3984}\end{array}$	$\begin{array}{r}32\text{R}5\\37\overline{)1189}\end{array}$	$\begin{array}{r}532\\26\overline{)13832}\end{array}$
13.	$\begin{array}{r}82\\39\overline{)3198}\end{array}$	$\begin{array}{r}62\\58\overline{)3596}\end{array}$	$\begin{array}{r}62\\27\overline{)1674}\end{array}$	$\begin{array}{r}362\\48\overline{)17376}\end{array}$
14.	$\begin{array}{r}56\text{R}3\\26\overline{)1459}\end{array}$	$\begin{array}{r}52\\37\overline{)1924}\end{array}$	$\begin{array}{r}95\\36\overline{)3420}\end{array}$	$\begin{array}{r}656\\27\overline{)17712}\end{array}$
15.	$\begin{array}{r}72\\19\overline{)1368}\end{array}$	$\begin{array}{r}72\text{R}3\\48\overline{)3459}\end{array}$	$\begin{array}{r}82\\46\overline{)3772}\end{array}$	$\begin{array}{r}826\\38\overline{)31388}\end{array}$
16.	$\begin{array}{r}85\\28\overline{)2380}\end{array}$	$\begin{array}{r}63\\47\overline{)2961}\end{array}$	$\begin{array}{r}62\\29\overline{)1798}\end{array}$	$\begin{array}{r}534\\56\overline{)29904}\end{array}$
17.	$\begin{array}{r}63\\57\overline{)3591}\end{array}$	$\begin{array}{r}84\\36\overline{)3024}\end{array}$	$\begin{array}{r}82\\58\overline{)4756}\end{array}$	$\begin{array}{r}653\\37\overline{)24161}\end{array}$
18.	$\begin{array}{r}62\\48\overline{)2976}\end{array}$	$\begin{array}{r}81\\27\overline{)2187}\end{array}$	$\begin{array}{r}74\\46\overline{)3404}\end{array}$	$\begin{array}{r}624\\57\overline{)35568}\end{array}$
19.	$\begin{array}{r}38\\57\overline{)2166}\end{array}$	$\begin{array}{r}64\\36\overline{)2304}\end{array}$	$\begin{array}{r}72\\58\overline{)4176}\end{array}$	$\begin{array}{r}735\\36\overline{)26460}\end{array}$

More Practice

⑫

1.	2513	3386	6917	5386	3724	4253
	609	2075	800	2617	1655	843
	1475	4147	2240	1009	3660	2069
	2840	5378	946	8446	976	857
	+1718	+2326	+3894	+5827	+491	+3179
	9155	17,312	14,797	23,285	10,506	11,201
2.	1351	3507	6274	3986	4230	4243
	4598	784	2178	1961	5947	380
	2496	2413	973	6386	5549	1021
	1088	540	7556	997	2381	909
	+3275	+4766	+2019	+1887	+7545	+6619
	12,808	12,010	19,000	15,217	25,652	13,172

3.	42784	32095	14448	95787	50000
	−15542	−18357	−4698	−78923	−19436
	27,242	13,738	9750	16,864	30,564
4.	40006	53195	17365	30000	43543
	−25687	−34796	−9698	−21725	−33658
	14,319	18,399	7667	8275	9885
5.	90000	82748	15300	61022	22476
	−40568	−26935	−6876	−49976	−13786
	49,432	55,813	8424	11,046	8690

⑬

6.	$3\frac{1}{4}$	$2\frac{3}{5}$	$5\frac{3}{8}$	$4\frac{7}{16}$	$5\frac{1}{2}$	$2\frac{1}{2}$	$1\frac{9}{10}$
	$+2\frac{3}{8}$	$+5\frac{1}{2}$	$+5\frac{3}{4}$	$+3\frac{1}{8}$	$+4\frac{11}{16}$	$+2\frac{7}{12}$	$+4\frac{3}{5}$
	$5\frac{5}{8}$	$8\frac{1}{10}$	$11\frac{1}{8}$	$7\frac{9}{16}$	$10\frac{3}{16}$	$5\frac{1}{12}$	$6\frac{1}{2}$
7.	$4\frac{1}{6}$	$1\frac{1}{2}$	$2\frac{3}{4}$	$6\frac{5}{12}$	$5\frac{3}{5}$	$3\frac{5}{16}$	$6\frac{3}{4}$
	$+4\frac{1}{3}$	$+7\frac{2}{3}$	$+4$	$+7\frac{1}{4}$	$+1\frac{3}{10}$	$+6\frac{3}{8}$	$+2\frac{7}{12}$
	$8\frac{1}{2}$	$9\frac{1}{6}$	$6\frac{3}{4}$	$13\frac{2}{3}$	$6\frac{9}{10}$	$9\frac{11}{16}$	$9\frac{1}{3}$
8.	$7\frac{1}{4}$	6	$1\frac{5}{6}$	$4\frac{1}{2}$	$5\frac{5}{6}$	$3\frac{3}{10}$	$8\frac{1}{4}$
	$+2\frac{1}{2}$	$+1\frac{7}{8}$	$+3\frac{2}{3}$	$+2\frac{7}{10}$	$+3\frac{1}{12}$	$+3\frac{1}{2}$	$+1\frac{1}{16}$
	$9\frac{3}{4}$	$7\frac{7}{8}$	$5\frac{1}{2}$	$7\frac{1}{5}$	$8\frac{11}{12}$	$6\frac{4}{5}$	$9\frac{5}{16}$
9.	$2\frac{1}{2}$	$3\frac{3}{4}$	$1\frac{1}{5}$	$4\frac{3}{16}$	$2\frac{1}{2}$	$1\frac{11}{12}$	$2\frac{9}{10}$
	$1\frac{5}{6}$	$2\frac{1}{2}$	$1\frac{2}{5}$	6	$\frac{1}{10}$	2	$2\frac{1}{2}$
	$+2\frac{1}{3}$	$+1\frac{3}{4}$	$+1\frac{1}{2}$	$+3\frac{3}{4}$	$+7\frac{1}{5}$	$+4\frac{1}{2}$	$+2\frac{3}{10}$
	$6\frac{2}{3}$	8	$4\frac{1}{10}$	$13\frac{15}{16}$	$9\frac{4}{5}$	$8\frac{5}{12}$	$7\frac{7}{10}$

⑭

1. $$\begin{array}{rrrrrrr} 9\frac{2}{3} & 6\frac{7}{8} & 7\frac{5}{6} & 2\frac{9}{10} & 8\frac{1}{2} & 5\frac{5}{6} & 6\frac{4}{5} \\ -5\frac{1}{3} & -3\frac{1}{4} & -5\frac{1}{6} & -2\frac{1}{2} & -3\frac{1}{16} & -4\frac{7}{12} & -6\frac{3}{10} \\ \hline 4\frac{1}{3} & 3\frac{5}{8} & 2\frac{2}{3} & \frac{2}{5} & 5\frac{7}{16} & 1\frac{1}{4} & \frac{1}{2} \end{array}$$

2. $$\begin{array}{rrrrrrr} 8\frac{5}{6} & 4\frac{1}{2} & 8\frac{3}{4} & 1\frac{11}{16} & 9\frac{3}{5} & 5\frac{3}{4} & 9\frac{7}{12} \\ -2\frac{2}{3} & -4\frac{1}{5} & -6\frac{1}{2} & -1\frac{5}{16} & -1\frac{1}{10} & -5\frac{5}{16} & -4\frac{1}{12} \\ \hline 6\frac{1}{6} & \frac{3}{10} & 2\frac{1}{4} & \frac{3}{8} & 8\frac{1}{2} & \frac{7}{16} & 5\frac{1}{2} \end{array}$$

3. $$\begin{array}{rrrrrrr} 9\frac{3}{4} & 9\frac{7}{8} & 8\frac{1}{3} & 7\frac{11}{12} & 6\frac{11}{16} & 7\frac{9}{10} & 5\frac{7}{10} \\ -7\frac{3}{4} & -2\frac{1}{8} & -4\frac{1}{4} & -2\frac{3}{4} & -5\frac{3}{8} & -3\frac{3}{10} & -1\frac{1}{2} \\ \hline 2 & 7\frac{3}{4} & 4\frac{1}{12} & 5\frac{1}{6} & 1\frac{5}{16} & 4\frac{3}{5} & 4\frac{1}{5} \end{array}$$

4. $$\begin{array}{rrrrrrr} 6\frac{2}{3} & 8\frac{1}{2} & 5\frac{1}{2} & 3\frac{3}{5} & 9\frac{2}{3} & 9\frac{7}{8} & 7\frac{11}{12} \\ -2 & -1\frac{3}{8} & -3\frac{1}{6} & -3\frac{3}{10} & -8\frac{5}{12} & -4\frac{9}{16} & -1\frac{1}{3} \\ \hline 4\frac{2}{3} & 7\frac{1}{8} & 2\frac{1}{3} & \frac{3}{10} & 1\frac{1}{4} & 5\frac{5}{16} & 6\frac{7}{12} \end{array}$$

⑮

Tell the missing numbers that go in the numerators:

5. $6 = 5\frac{?}{8}$ 8 $4\frac{1}{2} = 3\frac{?}{2}$ 3 $3\frac{5}{16} = 2\frac{?}{16}$ 21 $6\frac{3}{4} = 6\frac{6}{8} = 5\frac{?}{8}$ 14

6. $9 = 8\frac{?}{4}$ 4 $7\frac{1}{4} = 6\frac{?}{4}$ 5 $9\frac{7}{12} = 8\frac{?}{12}$ 19 $2\frac{1}{3} = 2\frac{?}{6}$ 2 $= 1\frac{?}{6}$ 8

7. $5 = 4\frac{?}{6}$ 6 $3\frac{2}{3} = 2\frac{?}{3}$ 5 $4\frac{3}{10} = 3\frac{?}{10}$ 13 $7\frac{1}{8} = 7\frac{?}{16}$ 2 $= 6\frac{?}{16}$ 18

8. $7 = 6\frac{?}{3}$ 3 $9\frac{1}{8} = 8\frac{?}{8}$ 9 $2\frac{11}{12} = 1\frac{?}{12}$ 23 $3\frac{3}{4} = 3\frac{?}{12}$ 9 $= 2\frac{?}{12}$ 21

9. $4 = 3\frac{?}{5}$ 5 $5\frac{4}{5} = 4\frac{?}{5}$ 9 $6\frac{13}{16} = 5\frac{?}{16}$ 29 $4\frac{3}{5} = 4\frac{?}{10}$ 6 $= 3\frac{?}{10}$ 16

⑯

10. $$\begin{array}{rrrrrrr} 7\frac{5}{8} & 1 & 9\frac{1}{6} & 8\frac{1}{8} & 6\frac{1}{16} & 5 & 8\frac{5}{12} \\ -2\frac{7}{8} & -\frac{5}{8} & -2\frac{5}{6} & -3\frac{7}{8} & -5\frac{11}{16} & -2\frac{7}{10} & -5\frac{7}{12} \\ \hline 4\frac{3}{4} & \frac{3}{8} & 6\frac{1}{3} & 4\frac{1}{4} & \frac{3}{8} & 2\frac{3}{10} & 2\frac{5}{6} \end{array}$$

11. $$\begin{array}{rrrrrrr} 9\frac{3}{5} & 6 & 8\frac{1}{3} & 7\frac{1}{4} & 5\frac{7}{12} & 8\frac{3}{16} & 9\frac{1}{10} \\ -6\frac{4}{5} & -\frac{3}{4} & -1\frac{2}{3} & -3\frac{3}{4} & -2\frac{11}{12} & -6\frac{9}{16} & -4\frac{9}{10} \\ \hline 2\frac{4}{5} & 5\frac{1}{4} & 6\frac{2}{3} & 3\frac{1}{2} & 2\frac{2}{3} & 1\frac{5}{8} & 4\frac{1}{5} \end{array}$$

12. $$\begin{array}{rrrrrrr} 7 & 5 & 9\frac{1}{8} & 9 & 6\frac{3}{10} & 9\frac{1}{12} & 6\frac{5}{16} \\ -6\frac{1}{2} & -\frac{2}{3} & -7\frac{5}{8} & -4\frac{3}{8} & -1\frac{7}{10} & -3\frac{11}{12} & -4\frac{15}{16} \\ \hline \frac{1}{2} & 4\frac{1}{3} & 1\frac{1}{2} & 4\frac{5}{8} & 4\frac{3}{5} & 5\frac{1}{6} & 1\frac{3}{8} \end{array}$$

More Practice

⑰

1. $2\frac{1}{2} + 1\frac{3}{5}$ $4\frac{1}{10}$ $2\frac{1}{2} - 1\frac{7}{12}$ $\frac{11}{12}$ $1\frac{3}{8} + 2\frac{1}{6}$ $3\frac{13}{24}$ $9\frac{1}{10} - 6\frac{1}{2}$ $2\frac{3}{5}$

2. $6\frac{1}{4} - 4\frac{3}{4}$ $1\frac{1}{2}$ $4\frac{1}{6} + 3\frac{1}{12}$ $7\frac{1}{4}$ $9\frac{5}{8} - 3\frac{7}{8}$ $5\frac{3}{4}$ $1\frac{3}{16} + 1\frac{3}{4}$ $2\frac{15}{16}$

3. $2\frac{1}{6} - 1\frac{3}{4}$ $\frac{5}{12}$ $7\frac{1}{2} - 4\frac{7}{10}$ $2\frac{4}{5}$ $4\frac{3}{4} + 5\frac{3}{4}$ $10\frac{1}{2}$ $3\frac{5}{12} + 4\frac{1}{3}$ $7\frac{3}{4}$

4. $3\frac{2}{3} + 3\frac{3}{4}$ $7\frac{5}{12}$ $5\frac{3}{8} + 3\frac{5}{16}$ $8\frac{11}{16}$ $10 - 4\frac{1}{3}$ $5\frac{2}{3}$ $8\frac{7}{10} - 7\frac{2}{5}$ $1\frac{3}{10}$

5. $4\frac{5}{6} + 4\frac{1}{4}$ $9\frac{1}{12}$ $8\frac{1}{2} - 5\frac{11}{16}$ $2\frac{13}{16}$ $2\frac{5}{6} + 4\frac{5}{6}$ $7\frac{2}{3}$ $6\frac{7}{12} + 3\frac{7}{8}$ $10\frac{11}{24}$

6. $5\frac{1}{8} - 1\frac{3}{8}$ $3\frac{3}{4}$ $1\frac{5}{6} + 6\frac{1}{12}$ $7\frac{11}{12}$ $15 - 6\frac{3}{8}$ $8\frac{5}{8}$ $4\frac{1}{16} - 2\frac{1}{2}$ $1\frac{9}{16}$

⑱

7. $2\frac{3}{4} \times 12$ 33 $9\frac{2}{3} \times 15$ 145 $4\frac{3}{5} \times 10$ 46 $12\frac{1}{2} \times 30$ 375

8. $6\frac{2}{5} \times 20$ 128 $5\frac{1}{4} \times 16$ 84 $2\frac{1}{8} \times 24$ 51 $15\frac{1}{4} \times 24$ 366

9. $3\frac{5}{6} \times 18$ 69 $3\frac{1}{3} \times 21$ 70 $5\frac{4}{5} \times 15$ 87 $10\frac{3}{8} \times 32$ 332

10. $7\frac{1}{2} \times 44$ 330 $2\frac{1}{6} \times 12$ 26 $1\frac{5}{8} \times 40$ 65 $11\frac{5}{6} \times 48$ 568

11. $3\frac{2}{3} \times 21$ 77 $6\frac{3}{4} \times 16$ 108 $4\frac{1}{2} \times 22$ 99 $10\frac{1}{3} \times 18$ 186

12. $4\frac{4}{5} \times 15$ 72 $3\frac{5}{6} \times 24$ 92 $3\frac{3}{8} \times 40$ 135 $12\frac{3}{4} \times 20$ 255

⑲

13. $1\frac{1}{2} \times 15$ $22\frac{1}{2}$ $3\frac{1}{2} \times 19$ $66\frac{1}{2}$ $7\frac{1}{2} \times 9$ $67\frac{1}{2}$ $3\frac{1}{4} \times 22$ $71\frac{1}{2}$

14. $2\frac{1}{3} \times 14$ $32\frac{2}{3}$ $2\frac{1}{4} \times 11$ $24\frac{3}{4}$ $1\frac{1}{3} \times 7$ $9\frac{1}{3}$ $1\frac{1}{8} \times 34$ $38\frac{1}{4}$

15. $2\frac{1}{2} \times 25$ $62\frac{1}{2}$ $3\frac{1}{8} \times 35$ $109\frac{3}{8}$ $4\frac{1}{2} \times 5$ $22\frac{1}{2}$ $2\frac{3}{4} \times 18$ $49\frac{1}{2}$

16. $1\frac{1}{4} \times 15$ $18\frac{3}{4}$ $5\frac{1}{2} \times 13$ $71\frac{1}{2}$ $3\frac{1}{3} \times 8$ $26\frac{2}{3}$ $6\frac{1}{2} \times 17$ $110\frac{1}{2}$

17. $5\frac{1}{4} \times 30$ $157\frac{1}{2}$ $1\frac{3}{4} \times 17$ $29\frac{3}{4}$ $2\frac{1}{8} \times 7$ $14\frac{7}{8}$ $1\frac{3}{8} \times 30$ $41\frac{1}{4}$

18. $1\frac{1}{5} \times 11$ $13\frac{1}{5}$ $1\frac{5}{8} \times 13$ $21\frac{1}{8}$ $3\frac{1}{6} \times 5$ $15\frac{5}{6}$ $4\frac{3}{5} \times 21$ $96\frac{3}{5}$

19. $2\frac{1}{6} \times 16$ $34\frac{2}{3}$ $2\frac{2}{5} \times 11$ $26\frac{2}{5}$ $3\frac{5}{6} \times 7$ $26\frac{5}{6}$ $3\frac{3}{4} \times 14$ $52\frac{1}{2}$

20. $4\frac{1}{4} \times 10$ $42\frac{1}{2}$ $1\frac{2}{3} \times 16$ $26\frac{2}{3}$ $3\frac{4}{5} \times 8$ $30\frac{2}{5}$ $4\frac{5}{6} \times 15$ $72\frac{1}{2}$

⑳

1. $7 \times 1\frac{1}{3}$ $9\frac{1}{3}$ $3 \times 4\frac{2}{5}$ $13\frac{1}{5}$ $5 \times 10\frac{1}{2}$ $52\frac{1}{2}$ $16 \times 12\frac{1}{4}$ 196

2. $6 \times 4\frac{1}{2}$ 27 $8 \times 5\frac{1}{4}$ 42 $3 \times 14\frac{3}{4}$ $44\frac{1}{4}$ $15 \times 11\frac{5}{6}$ $177\frac{1}{2}$

3. $5 \times 3\frac{5}{8}$ $18\frac{1}{8}$ $4 \times 6\frac{2}{3}$ $26\frac{2}{3}$ $8 \times 25\frac{1}{6}$ $201\frac{1}{3}$ $24 \times 17\frac{1}{8}$ 411

4. $6 \times 2\frac{3}{4}$ $16\frac{1}{2}$ $6 \times 3\frac{7}{8}$ $23\frac{1}{4}$ $9 \times 15\frac{2}{3}$ 141 $16 \times 12\frac{3}{5}$ $201\frac{3}{5}$

5. $4 \times 1\frac{5}{6}$ $7\frac{1}{3}$ $3 \times 2\frac{4}{5}$ $8\frac{2}{5}$ $6 \times 21\frac{1}{2}$ 129 $18 \times 16\frac{3}{8}$ $294\frac{3}{4}$

6. $5 \times 4\frac{2}{3}$ $23\frac{1}{3}$ $4 \times 7\frac{1}{8}$ $28\frac{1}{2}$ $4 \times 16\frac{1}{3}$ $65\frac{1}{3}$ $10 \times 18\frac{2}{3}$ $186\frac{2}{3}$

㉑

7. $\frac{1}{6} \times \frac{4}{5}$ $\frac{2}{15}$ $\frac{3}{8} \times 6$ $2\frac{1}{4}$ $9 \times \frac{1}{6}$ $1\frac{1}{2}$ $\frac{3}{4} \times 14$ $10\frac{1}{2}$ $\frac{1}{6} \times \frac{9}{10}$ $\frac{3}{20}$

8. $6 \times \frac{5}{8}$ $3\frac{3}{4}$ $\frac{7}{8} \times 6$ $5\frac{1}{4}$ $2 \times \frac{3}{4}$ $1\frac{1}{2}$ $\frac{5}{6} \times \frac{3}{10}$ $\frac{1}{4}$ $8 \times \frac{3}{10}$ $2\frac{2}{5}$

9. $\frac{5}{6} \times 9$ $7\frac{1}{2}$ $6 \times \frac{3}{4}$ $4\frac{1}{2}$ $8 \times \frac{5}{6}$ $6\frac{2}{3}$ $\frac{5}{8} \times 20$ $12\frac{1}{2}$ $\frac{4}{5} \times \frac{3}{10}$ $\frac{6}{25}$

10. $\frac{1}{6} \times 8$ $1\frac{1}{3}$ $4 \times \frac{5}{6}$ $3\frac{1}{3}$ $\frac{7}{8} \times 6$ $5\frac{1}{4}$ $6 \times \frac{7}{10}$ $4\frac{1}{5}$ $\frac{5}{6} \times 10$ $8\frac{1}{3}$

11. $6 \times \frac{3}{8}$ $2\frac{1}{4}$ $\frac{5}{6} \times \frac{4}{5}$ $\frac{2}{3}$ $\frac{1}{4} \times 6$ $1\frac{1}{2}$ $\frac{4}{5} \times \frac{1}{10}$ $\frac{2}{25}$ $\frac{5}{6} \times \frac{9}{10}$ $\frac{3}{4}$

12. $6 \times \frac{1}{4}$ $1\frac{1}{2}$ $\frac{1}{4} \times \frac{6}{7}$ $\frac{3}{14}$ $\frac{5}{6} \times \frac{8}{9}$ $\frac{20}{27}$ $6 \times \frac{1}{10}$ $\frac{3}{5}$ $\frac{1}{6} \times \frac{15}{16}$ $\frac{5}{32}$

㉒

13. $\frac{4}{5} \times 4\frac{1}{6}$ $3\frac{1}{3}$ $\frac{3}{4} \times 1\frac{1}{3}$ 1 $4\frac{1}{2} \times 3\frac{1}{3}$ 15 $2\frac{1}{2} \times 2\frac{1}{2}$ $6\frac{1}{4}$

14. $\frac{5}{6} \times 1\frac{3}{5}$ $1\frac{1}{3}$ $\frac{4}{5} \times 7\frac{1}{2}$ 6 $1\frac{7}{8} \times 1\frac{1}{5}$ $2\frac{1}{4}$ $3\frac{1}{3} \times \frac{9}{10}$ 3

15. $\frac{3}{8} \times 2\frac{2}{5}$ $\frac{9}{10}$ $\frac{1}{4} \times 6\frac{2}{3}$ $1\frac{2}{3}$ $1\frac{3}{5} \times 3\frac{3}{4}$ 6 $\frac{15}{16} \times 1\frac{3}{5}$ $1\frac{1}{2}$

16. $\frac{2}{5} \times 2\frac{1}{2}$ 1 $\frac{5}{6} \times 4\frac{1}{5}$ $3\frac{1}{2}$ $1\frac{1}{8} \times 5\frac{1}{3}$ 6 $1\frac{1}{3} \times 7\frac{1}{2}$ 10

17. $\frac{5}{8} \times 2\frac{2}{5}$ $1\frac{1}{2}$ $\frac{2}{3} \times 4\frac{1}{2}$ 3 $1\frac{1}{3} \times 1\frac{1}{8}$ $1\frac{1}{2}$ $\frac{3}{16} \times 2\frac{2}{3}$ $\frac{1}{2}$

18. $\frac{2}{3} \times 1\frac{7}{8}$ $1\frac{1}{4}$ $\frac{3}{4} \times 3\frac{3}{5}$ $2\frac{7}{10}$ $1\frac{3}{4} \times 1\frac{1}{4}$ $2\frac{3}{16}$ $\frac{9}{10} \times 8\frac{1}{3}$ $7\frac{1}{2}$

19. $\frac{4}{5} \times 3\frac{1}{3}$ $2\frac{2}{3}$ $\frac{5}{8} \times 4\frac{4}{5}$ 3 $5\frac{1}{4} \times 2\frac{2}{3}$ 14 $\frac{7}{12} \times 1\frac{1}{5}$ $\frac{7}{10}$

More Practice

㉓

Change to fractions:

1. .40 $\frac{2}{5}$ .16 $\frac{4}{25}$ .72 $\frac{18}{25}$ .95 $\frac{19}{20}$ .375 $\frac{3}{8}$ .225 $\frac{9}{40}$ .475 $\frac{19}{40}$
2. .75 $\frac{3}{4}$ .45 $\frac{9}{20}$ .14 $\frac{7}{50}$ .84 $\frac{21}{25}$ .150 $\frac{3}{20}$ .775 $\frac{31}{40}$ .500 $\frac{1}{2}$
3. .48 $\frac{12}{25}$ .80 $\frac{4}{5}$ .56 $\frac{14}{25}$ .92 $\frac{23}{25}$ .125 $\frac{1}{8}$ .350 $\frac{7}{20}$ .575 $\frac{23}{40}$
4. .70 $\frac{7}{10}$ .96 $\frac{24}{25}$ .10 $\frac{1}{10}$ .64 $\frac{16}{25}$ .675 $\frac{27}{40}$ .825 $\frac{33}{40}$ .850 $\frac{17}{20}$

㉔

5. 194 × 4603 892,982 750 × 6139 4,604,250 846 × 3060 2,588,760
6. 507 × 8005 4,058,535 918 × 1785 1,638,630 620 × 4179 2,590,980
7. 632 × 3826 2,418,032 240 × 4582 1,099,680 537 × 2471 1,326,927
8. 358 × 2974 1,064,692 369 × 5920 2,184,480 204 × 1697 346,188

㉕

9. 6 × 4.3 25.8 3 × .27 .81 6 × .019 .114 15 × 1.7 25.5
10. 9 × 1.8 16.2 8 × .06 .48 9 × .134 1.206 12 × .14 1.68
11. 7 × 4.5 31.5 2 × .58 1.16 4 × .007 .028 18 × .08 1.44
12. 5 × 3.5 17.5 4 × .24 .96 2 × .009 .018 14 × .07 .98

㉖

13. 7.1 × 11.2 79.52 6.2 × 12.4 76.88 5.1 × 5.03 25.653 3.2 × 5.13 16.416
14. 4.2 × 15.3 64.26 2.1 × 4.12 8.652 9.3 × 9.05 84.165 4.1 × 9.02 36.982
15. 5.3 × 12.2 64.66 7.3 × 4.15 30.295 8.2 × 7.11 58.302 5.2 × 7.09 36.868
16. 8.1 × 40.3 326.43 4.9 × 83.2 407.68 9.1 × 2.04 18.564 9.2 × 6.01 55.292

㉗

Change to lowest terms:

17. $\frac{18}{96}$ $\frac{3}{16}$ $\frac{36}{64}$ $\frac{9}{16}$ $\frac{25}{80}$ $\frac{5}{16}$ $\frac{32}{96}$ $\frac{1}{3}$ $\frac{120}{225}$ $\frac{8}{15}$ $\frac{75}{105}$ $\frac{5}{7}$ $\frac{180}{315}$ $\frac{4}{7}$ $\frac{150}{225}$ $\frac{2}{3}$
18. $\frac{16}{48}$ $\frac{1}{3}$ $\frac{12}{30}$ $\frac{2}{5}$ $\frac{15}{75}$ $\frac{1}{5}$ $\frac{40}{55}$ $\frac{8}{11}$ $\frac{170}{250}$ $\frac{17}{25}$ $\frac{40}{160}$ $\frac{1}{4}$ $\frac{210}{360}$ $\frac{7}{12}$ $\frac{245}{420}$ $\frac{7}{12}$

㉘

1. $\overset{6}{623\overline{)3738}}$ $\overset{3}{431\overline{)1293}}$ $\overset{17}{536\overline{)9112}}$ $\overset{53}{427\overline{)22631}}$

2. $\overset{7}{713\overline{)4991}}$ $\overset{7\text{ R }101}{324\overline{)2369}}$ $\overset{23\text{ R }23}{409\overline{)9430}}$ $\overset{74}{716\overline{)52984}}$

3. $\overset{7\text{ R }102}{554\overline{)3980}}$ $\overset{3}{351\overline{)1053}}$ $\overset{24}{242\overline{)5808}}$ $\overset{41\text{ R }20}{319\overline{)13099}}$

4. $\overset{6}{344\overline{)2064}}$ $\overset{3\text{ R }326}{641\overline{)2249}}$ $\overset{16}{328\overline{)5248}}$ $\overset{73}{654\overline{)47742}}$

5. $\overset{6\text{ R }207}{418\overline{)2715}}$ $\overset{8}{538\overline{)4304}}$ $\overset{17}{451\overline{)7667}}$ $\overset{26}{623\overline{)16198}}$

6. $\overset{8}{331\overline{)2648}}$ $\overset{9\text{ R }10}{427\overline{)3853}}$ $\overset{19}{206\overline{)3914}}$ $\overset{64}{546\overline{)34944}}$

㉙

7. $\overset{76}{538\overline{)40888}}$ $\overset{77\frac{143}{271}}{542\overline{)42020}}$ $\overset{194}{518\overline{)100492}}$

8. $\overset{37\frac{211}{427}}{427\overline{)16010}}$ $\overset{79}{913\overline{)72127}}$ $\overset{419}{342\overline{)143298}}$

9. $\overset{51\frac{309}{352}}{352\overline{)18261}}$ $\overset{49\frac{2}{13}}{416\overline{)20448}}$ $\overset{384}{531\overline{)203904}}$

10. $\overset{67}{243\overline{)16281}}$ $\overset{58\frac{401}{634}}{634\overline{)37173}}$ $\overset{659}{442\overline{)291278}}$

11. $\overset{44\frac{4}{9}}{225\overline{)10000}}$ $\overset{79\frac{25}{63}}{252\overline{)20008}}$ $\overset{787}{651\overline{)512337}}$

12. $\overset{195\frac{341}{412}}{412\overline{)80681}}$ $\overset{259\frac{1}{4}}{252\overline{)65331}}$ $\overset{643\frac{108}{169}}{338\overline{)217550}}$

㉚

13. $\overset{97\text{ R }800}{896\overline{)87712}}$ $\overset{417\text{ R }70}{193\overline{)80551}}$ $\overset{573\text{ R }19}{394\overline{)225781}}$

14. $\overset{71\text{ R }42}{585\overline{)41577}}$ $\overset{223}{268\overline{)59764}}$ $\overset{547}{461\overline{)252167}}$

15. $\overset{52}{662\overline{)34424}}$ $\overset{73\text{ R }125}{689\overline{)50422}}$ $\overset{254}{582\overline{)147828}}$

16. $\overset{42}{475\overline{)19950}}$ $\overset{334}{275\overline{)91850}}$ $\overset{275}{571\overline{)157025}}$

17. $\overset{279}{194\overline{)54126}}$ $\overset{66}{371\overline{)24486}}$ $\overset{543}{482\overline{)261726}}$

18. $\overset{53}{365\overline{)19345}}$ $\overset{62}{284\overline{)17608}}$ $\overset{627}{381\overline{)238887}}$

More Practice

㉛

1. $8 \div \frac{2}{3}$ 12 $7 \div \frac{3}{5}$ $11\frac{2}{3}$ $9 \div \frac{3}{4}$ 12 $20 \div \frac{5}{8}$ 32 $14 \div \frac{7}{10}$ 20
2. $5 \div \frac{5}{8}$ 8 $5 \div \frac{2}{3}$ $7\frac{1}{2}$ $4 \div \frac{3}{5}$ $6\frac{2}{3}$ $24 \div \frac{3}{4}$ 32 $10 \div \frac{15}{16}$ $10\frac{2}{3}$
3. $6 \div \frac{3}{4}$ 8 $3 \div \frac{3}{8}$ 8 $2 \div \frac{7}{8}$ $2\frac{2}{7}$ $15 \div \frac{2}{3}$ $22\frac{1}{2}$ $15 \div \frac{5}{12}$ 36
4. $2 \div \frac{3}{4}$ $2\frac{2}{3}$ $6 \div \frac{4}{5}$ $7\frac{1}{2}$ $9 \div \frac{5}{6}$ $10\frac{4}{5}$ $18 \div \frac{4}{5}$ $22\frac{1}{2}$ $24 \div \frac{9}{10}$ $26\frac{2}{3}$
5. $5 \div \frac{5}{6}$ 6 $8 \div \frac{2}{5}$ 20 $5 \div \frac{3}{4}$ $6\frac{2}{3}$ $12 \div \frac{2}{3}$ 18 $27 \div \frac{9}{16}$ 48

㉜

6. $1\frac{1}{4} \div \frac{3}{4}$ $1\frac{2}{3}$ $4\frac{1}{5} \div \frac{3}{4}$ $5\frac{3}{5}$ $\frac{15}{16} \div \frac{5}{8}$ $1\frac{1}{2}$ $\frac{1}{8} \div \frac{3}{4}$ $\frac{1}{6}$ $\frac{3}{4} \div \frac{2}{3}$ $1\frac{1}{8}$
7. $5\frac{1}{3} \div \frac{2}{3}$ 8 $7\frac{1}{2} \div \frac{3}{4}$ 10 $\frac{9}{10} \div \frac{1}{8}$ $7\frac{1}{5}$ $\frac{1}{2} \div \frac{3}{8}$ $1\frac{1}{3}$ $\frac{2}{3} \div \frac{5}{6}$ $\frac{4}{5}$
8. $2\frac{3}{4} \div \frac{1}{2}$ $5\frac{1}{2}$ $8\frac{1}{3} \div \frac{5}{6}$ 10 $\frac{9}{16} \div \frac{1}{3}$ $1\frac{11}{16}$ $\frac{2}{3} \div \frac{1}{5}$ $3\frac{1}{3}$ $\frac{1}{6} \div \frac{2}{3}$ $\frac{1}{4}$
9. $2\frac{2}{3} \div \frac{1}{4}$ $10\frac{2}{3}$ $2\frac{5}{8} \div \frac{3}{5}$ $4\frac{3}{8}$ $\frac{5}{16} \div \frac{3}{8}$ $\frac{5}{6}$ $\frac{7}{8} \div \frac{1}{4}$ $3\frac{1}{2}$ $\frac{5}{8} \div \frac{3}{4}$ $\frac{5}{6}$
10. $1\frac{1}{8} \div \frac{2}{3}$ $1\frac{11}{16}$ $3\frac{3}{4} \div \frac{5}{8}$ 6 $\frac{3}{10} \div \frac{1}{3}$ $\frac{9}{10}$ $\frac{2}{3} \div \frac{1}{2}$ $1\frac{1}{3}$ $\frac{1}{4} \div \frac{1}{3}$ $\frac{3}{4}$

㉝

11. $1\frac{3}{4} \div \frac{7}{8}$ 2 $3\frac{2}{3} \div \frac{11}{12}$ 4 $\frac{3}{4} \div \frac{2}{3}$ $1\frac{1}{8}$ $\frac{2}{3} \div \frac{5}{12}$ $1\frac{3}{5}$ $\frac{9}{10} \div \frac{3}{16}$ $4\frac{4}{5}$
12. $1\frac{7}{8} \div \frac{5}{6}$ $2\frac{1}{4}$ $4\frac{1}{8} \div \frac{3}{16}$ 22 $\frac{5}{6} \div \frac{2}{5}$ $2\frac{1}{12}$ $\frac{3}{4} \div \frac{3}{16}$ 4 $\frac{15}{16} \div \frac{5}{12}$ $2\frac{1}{4}$
13. $5\frac{1}{2} \div \frac{3}{4}$ $7\frac{1}{3}$ $3\frac{3}{4} \div \frac{3}{16}$ 20 $\frac{2}{3} \div \frac{1}{8}$ $5\frac{1}{3}$ $\frac{5}{8} \div \frac{15}{16}$ $\frac{2}{3}$ $\frac{9}{16} \div \frac{9}{10}$ $\frac{5}{8}$
14. $2\frac{2}{3} \div \frac{4}{5}$ $3\frac{1}{3}$ $1\frac{1}{2} \div \frac{15}{16}$ $1\frac{3}{5}$ $\frac{4}{5} \div \frac{2}{3}$ $1\frac{1}{5}$ $\frac{3}{4} \div \frac{9}{16}$ $1\frac{1}{3}$ $\frac{9}{10} \div \frac{15}{16}$ $\frac{24}{25}$
15. $2\frac{2}{5} \div \frac{2}{3}$ $3\frac{3}{5}$ $6\frac{1}{8} \div \frac{7}{12}$ $10\frac{1}{2}$ $\frac{5}{8} \div \frac{1}{6}$ $3\frac{3}{4}$ $\frac{5}{6} \div \frac{1}{12}$ 10 $\frac{11}{12} \div \frac{11}{16}$ $1\frac{1}{3}$

㉞

16. $\frac{1}{2} \div 4$ $\frac{1}{8}$ $\frac{15}{16} \div 5$ $\frac{3}{16}$ $7\frac{1}{2} \div 9$ $\frac{5}{6}$ $3\frac{3}{4} \div 3$ $1\frac{1}{4}$ $7\frac{1}{2} \div 10$ $\frac{3}{4}$
17. $\frac{3}{4} \div 6$ $\frac{1}{8}$ $\frac{9}{16} \div 6$ $\frac{3}{32}$ $6\frac{1}{4} \div 5$ $1\frac{1}{4}$ $1\frac{4}{5} \div 6$ $\frac{3}{10}$ $2\frac{1}{4} \div 12$ $\frac{3}{16}$
18. $\frac{4}{5} \div 6$ $\frac{2}{15}$ $\frac{9}{10} \div 3$ $\frac{3}{10}$ $3\frac{1}{2} \div 2$ $1\frac{3}{4}$ $6\frac{1}{8} \div 7$ $\frac{7}{8}$ $8\frac{1}{4} \div 11$ $\frac{3}{4}$
19. $\frac{2}{5} \div 4$ $\frac{1}{10}$ $\frac{11}{16} \div 2$ $\frac{11}{32}$ $4\frac{1}{4} \div 4$ $1\frac{1}{16}$ $8\frac{1}{3} \div 5$ $1\frac{2}{3}$ $2\frac{2}{3} \div 16$ $\frac{1}{6}$

㉟

1. $5\frac{2}{5} \div \frac{3}{4}$ $7\frac{1}{5}$ $1\frac{1}{2} \div 2$ $\frac{3}{4}$ $6\frac{3}{4} \div 6$ $1\frac{1}{8}$ $\frac{15}{16} \div \frac{9}{10}$ $1\frac{1}{24}$

2. $3\frac{3}{4} \div 9$ $\frac{5}{12}$ $\frac{7}{16} \div \frac{7}{8}$ $\frac{1}{2}$ $\frac{15}{16} \div \frac{3}{4}$ $1\frac{1}{4}$ $33 \div \frac{11}{12}$ 36

3. $4\frac{1}{6} \div 5$ $\frac{5}{6}$ $12 \div \frac{1}{2}$ 24 $4\frac{1}{2} \div \frac{2}{3}$ $6\frac{3}{4}$ $7\frac{1}{2} \div \frac{15}{16}$ 8

4. $1\frac{4}{5} \div \frac{3}{5}$ 3 $2\frac{2}{3} \div 4$ $\frac{2}{3}$ $21 \div \frac{7}{8}$ 24 $3\frac{3}{4} \div \frac{15}{16}$ 4

5. $7\frac{1}{2} \div 6$ $1\frac{1}{4}$ $\frac{15}{16} \div \frac{3}{8}$ $2\frac{1}{2}$ $4\frac{1}{2} \div 3$ $1\frac{1}{2}$ $6\frac{3}{5} \div \frac{11}{12}$ $7\frac{1}{5}$

6. $18 \div \frac{2}{3}$ 27 $5\frac{1}{3} \div \frac{4}{5}$ $6\frac{2}{3}$ $6\frac{2}{3} \div 8$ $\frac{5}{6}$ $7\frac{1}{2} \div 12$ $\frac{5}{8}$

7. $3\frac{1}{2} \div 7$ $\frac{1}{2}$ $11 \div \frac{1}{3}$ 33 $25 \div \frac{5}{6}$ 30 $1\frac{3}{4} \div \frac{7}{16}$ 4

㊱

8. $6 \div 1\frac{1}{2}$ 4 $7\frac{1}{2} \div 1\frac{1}{2}$ 5 $15 \div 1\frac{1}{4}$ 12 $\$1.50 \div 1\frac{7}{8}$ $\$.80$

9. $\frac{5}{8} \div 3\frac{1}{8}$ $\frac{1}{5}$ $5\frac{1}{3} \div 1\frac{2}{3}$ $3\frac{1}{5}$ $6\frac{1}{4} \div 1\frac{1}{2}$ $4\frac{1}{6}$ $\$2.00 \div 6\frac{2}{3}$ $\$.30$

10. $9 \div 1\frac{7}{8}$ $4\frac{4}{5}$ $3\frac{1}{3} \div 1\frac{1}{4}$ $2\frac{2}{3}$ $4\frac{1}{8} \div 1\frac{1}{2}$ $2\frac{3}{4}$ $\$1.00 \div 8\frac{1}{3}$ $\$.12$

11. $5 \div 6\frac{2}{3}$ $\frac{3}{4}$ $8\frac{1}{4} \div 2\frac{3}{4}$ 3 $5\frac{1}{4} \div 1\frac{7}{8}$ $2\frac{4}{5}$ $\$1.25 \div 6\frac{1}{4}$ $\$.20$

12. $\frac{7}{8} \div 5\frac{1}{4}$ $\frac{1}{6}$ $\frac{11}{12} \div 3\frac{2}{3}$ $\frac{1}{4}$ $\frac{15}{16} \div 6\frac{1}{4}$ $\frac{3}{20}$ $\$2.50 \div 8\frac{1}{3}$ $\$.30$

13. $\frac{2}{3} \div 3\frac{1}{3}$ $\frac{1}{5}$ $\frac{9}{10} \div 1\frac{1}{5}$ $\frac{3}{4}$ $5\frac{1}{3} \div 2\frac{2}{3}$ 2 $\$1.00 \div 3\frac{1}{3}$ $\$.30$

14. $\frac{3}{4} \div 1\frac{1}{8}$ $\frac{2}{3}$ $4\frac{1}{2} \div 2\frac{1}{4}$ 2 $24 \div 1\frac{1}{5}$ 20 $\$2.00 \div 4\frac{1}{6}$ $\$.48$

㊲

15. $9 \div 3\frac{3}{8}$ $2\frac{2}{3}$ $16 \div 6\frac{2}{5}$ $2\frac{1}{2}$ $1\frac{3}{4} \div 4\frac{3}{8}$ $\frac{2}{5}$ $14 \div 1\frac{2}{5}$ 10

16. $\frac{4}{5} \div 1\frac{3}{5}$ $\frac{1}{2}$ $\frac{11}{16} \div 3\frac{2}{3}$ $\frac{3}{16}$ $4\frac{1}{6} \div 1\frac{2}{3}$ $2\frac{1}{2}$ $\frac{9}{10} \div 5\frac{5}{8}$ $\frac{4}{25}$

17. $6 \div 4\frac{1}{2}$ $1\frac{1}{3}$ $\frac{5}{12} \div 2\frac{1}{2}$ $\frac{1}{6}$ $1\frac{7}{8} \div 3\frac{3}{4}$ $\frac{1}{2}$ $15 \div 3\frac{3}{5}$ $4\frac{1}{6}$

18. $6 \div 1\frac{4}{5}$ $3\frac{1}{3}$ $18 \div 6\frac{3}{4}$ $2\frac{2}{3}$ $4\frac{2}{5} \div 6\frac{3}{5}$ $\frac{2}{3}$ $\frac{9}{16} \div 1\frac{1}{8}$ $\frac{1}{2}$

19. $\frac{5}{6} \div 3\frac{1}{3}$ $\frac{1}{4}$ $\frac{11}{12} \div 2\frac{3}{4}$ $\frac{1}{3}$ $3\frac{1}{4} \div 4\frac{7}{8}$ $\frac{2}{3}$ $4\frac{1}{6} \div 6\frac{1}{4}$ $\frac{2}{3}$

20. $9 \div 5\frac{2}{5}$ $1\frac{2}{3}$ $10 \div 7\frac{1}{2}$ $1\frac{1}{3}$ $4\frac{1}{2} \div 2\frac{2}{5}$ $1\frac{7}{8}$ $4\frac{2}{3} \div 5\frac{3}{5}$ $\frac{5}{6}$

More Practice

㊳

Find the number that belongs in each space:

1. 9 is $\overset{3}{\ldots}$ times 3. 4100 is $\overset{205}{\ldots}$ times 20.

2. 6 is $\overset{3}{\ldots}$ times 2. 6150 is $\overset{410}{\ldots}$ times 15.

3. 8 is $\overset{2}{\ldots}$ times 4. 2952 is $\overset{82}{\ldots}$ times 36.

4. 5 is $\overset{2\frac{1}{2}}{\ldots}$ times 2. 3000 is $\overset{33\frac{1}{3}}{\ldots}$ times 90.

5. 9 is $\overset{2\frac{1}{4}}{\ldots}$ times 4. 1568 is $\overset{37\frac{1}{3}}{\ldots}$ times 42.

6. 6 is $\overset{1\frac{1}{2}}{\ldots}$ times 4. 5280 is $\overset{60}{\ldots}$ times 88.

㊴

Find the number that belongs in each space:

7. 8 is $\frac{1}{2}$ of $\overset{16}{\ldots}$ 24 is $\frac{3}{8}$ of $\overset{64}{\ldots}$ 60 is $\frac{1}{3}$ of $\overset{180}{\ldots}$

8. 6 is $\frac{3}{4}$ of $\overset{8}{\ldots}$ 40 is $\frac{5}{6}$ of $\overset{48}{\ldots}$ 64 is $\frac{4}{5}$ of $\overset{80}{\ldots}$

9. 8 is $\frac{2}{5}$ of $\overset{20}{\ldots}$ 36 is $\frac{2}{3}$ of $\overset{54}{\ldots}$ 20 is $\frac{5}{8}$ of $\overset{32}{\ldots}$

10. 6 is $\frac{1}{6}$ of $\overset{36}{\ldots}$ 18 is $\frac{1}{4}$ of $\overset{72}{\ldots}$ 45 is $\frac{3}{4}$ of $\overset{60}{\ldots}$

11. 8 is $\frac{2}{3}$ of $\overset{12}{\ldots}$ 63 is $\frac{3}{5}$ of $\overset{105}{\ldots}$ 63 is $\frac{7}{8}$ of $\overset{72}{\ldots}$

12. 9 is $\frac{1}{8}$ of $\overset{72}{\ldots}$ 35 is $\frac{5}{6}$ of $\overset{42}{\ldots}$ 45 is $\frac{5}{8}$ of $\overset{72}{\ldots}$

㊵

13. $\begin{array}{r}2.3\\4\overline{)9.2}\end{array}$ $\begin{array}{r}.35\\9\overline{)3.15}\end{array}$ $\begin{array}{r}.89\\7\overline{)6.23}\end{array}$ $\begin{array}{r}6.5\\19\overline{)123.5}\end{array}$ $\begin{array}{r}5.8\\57\overline{)330.6}\end{array}$

14. $\begin{array}{r}.6\\8\overline{)4.8}\end{array}$ $\begin{array}{r}13.5\\5\overline{)67.5}\end{array}$ $\begin{array}{r}4.7\\9\overline{)42.3}\end{array}$ $\begin{array}{r}.87\\25\overline{)21.75}\end{array}$ $\begin{array}{r}.142\\43\overline{)6.106}\end{array}$

15. $\begin{array}{r}.14\\6\overline{).84}\end{array}$ $\begin{array}{r}.124\\7\overline{).868}\end{array}$ $\begin{array}{r}.214\\3\overline{).642}\end{array}$ $\begin{array}{r}.44\\32\overline{)14.08}\end{array}$ $\begin{array}{r}21.3\\46\overline{)979.8}\end{array}$

16. $\begin{array}{r}2.9\\3\overline{)8.7}\end{array}$ $\begin{array}{r}.229\\4\overline{).916}\end{array}$ $\begin{array}{r}.98\\6\overline{)5.88}\end{array}$ $\begin{array}{r}17.3\\22\overline{)380.6}\end{array}$ $\begin{array}{r}2.56\\31\overline{)79.36}\end{array}$

17. $\begin{array}{r}4.8\\2\overline{)9.6}\end{array}$ $\begin{array}{r}.93\\5\overline{)4.65}\end{array}$ $\begin{array}{r}1.07\\8\overline{)8.56}\end{array}$ $\begin{array}{r}.89\\38\overline{)33.82}\end{array}$ $\begin{array}{r}4.7\\64\overline{)300.8}\end{array}$

More Practice

41

Annex 0's to the dividend to avoid a remainder:

1. $\overset{1.5}{4\overline{)6.0}}$ $\overset{5.5}{6\overline{)33.0}}$ $\overset{54.6}{5\overline{)273.0}}$ $\overset{75.5}{2\overline{)151.0}}$ $\overset{26.75}{8\overline{)214.00}}$

2. $\overset{1.8}{5\overline{)9.0}}$ $\overset{4.5}{8\overline{)36.0}}$ $\overset{98.5}{2\overline{)197.0}}$ $\overset{49.5}{6\overline{)297.0}}$ $\overset{239.5}{4\overline{)958.0}}$

3. $\overset{3.5}{2\overline{)7.0}}$ $\overset{3.2}{5\overline{)16.0}}$ $\overset{67.5}{6\overline{)405.0}}$ $\overset{78.25}{4\overline{)313.00}}$ $\overset{18.25}{8\overline{)146.00}}$

4. $\overset{1.5}{6\overline{)9.0}}$ $\overset{4.75}{4\overline{)19.00}}$ $\overset{37.25}{8\overline{)298.00}}$ $\overset{96.4}{5\overline{)482.0}}$ $\overset{423.5}{2\overline{)847.0}}$

5. $\overset{1.75}{4\overline{)7.00}}$ $\overset{5.6}{5\overline{)28.0}}$ $\overset{179.5}{2\overline{)359.0}}$ $\overset{42.5}{8\overline{)340.0}}$ $\overset{65.8}{5\overline{)329.0}}$

42

Annex 0's to the dividend to avoid a remainder:

6. $\overset{1.25}{4\overline{)5.00}}$ $\overset{1.875}{8\overline{)15.000}}$ $\overset{3.16}{25\overline{)79.00}}$ $\overset{1.25}{60\overline{)75.00}}$ $\overset{1.65}{24\overline{)39.60}}$

7. $\overset{2.25}{4\overline{)9.00}}$ $\overset{2.4}{5\overline{)12.0}}$ $\overset{1.875}{24\overline{)45.000}}$ $\overset{1.125}{48\overline{)54.000}}$ $\overset{.864}{25\overline{)21.600}}$

8. $\overset{3.5}{2\overline{)7.0}}$ $\overset{8.375}{8\overline{)67.000}}$ $\overset{7.75}{12\overline{)93.00}}$ $\overset{1.5}{66\overline{)99.0}}$ $\overset{2.375}{28\overline{)66.500}}$

9. $\overset{1.6}{5\overline{)8.0}}$ $\overset{3.75}{4\overline{)15.00}}$ $\overset{1.75}{36\overline{)63.00}}$ $\overset{2.36}{25\overline{)59.00}}$ $\overset{1.85}{44\overline{)81.40}}$

10. $\overset{1.5}{6\overline{)9.0}}$ $\overset{2.375}{8\overline{)19.000}}$ $\overset{1.88}{25\overline{)47.00}}$ $\overset{1.5}{32\overline{)48.0}}$ $\overset{2.45}{22\overline{)53.90}}$

11. $\overset{1.125}{8\overline{)9.000}}$ $\overset{6.6}{5\overline{)33.0}}$ $\overset{2.875}{16\overline{)46.000}}$ $\overset{.625}{72\overline{)45.000}}$ $\overset{2.436}{25\overline{)60.900}}$

12. $\overset{1.4}{5\overline{)7.0}}$ $\overset{6.625}{8\overline{)53.000}}$ $\overset{6.5}{14\overline{)91.0}}$ $\overset{2.52}{25\overline{)63.00}}$ $\overset{2.35}{24\overline{)56.40}}$

43

Change to decimals correct to the nearest hundredth:

13. $\frac{1}{6}$ .17 $\frac{2}{3}$ .67 $\frac{5}{7}$ .71 $\frac{3}{11}$ .27 $\frac{11}{12}$ .92 $\frac{4}{15}$ .27 $\frac{13}{74}$ .18 $\frac{19}{75}$ .25

14. $\frac{1}{9}$ .11 $\frac{7}{9}$ .78 $\frac{5}{6}$ .83 $\frac{5}{12}$ .42 $\frac{2}{15}$ .13 $\frac{5}{11}$ .45 $\frac{19}{56}$ .34 $\frac{37}{43}$ .86

15. $\frac{1}{3}$ .33 $\frac{4}{7}$ .57 $\frac{5}{9}$ .56 $\frac{13}{15}$ .87 $\frac{5}{14}$ .36 $\frac{9}{11}$ .82 $\frac{31}{37}$ .84 $\frac{67}{89}$ .75

16. $\frac{2}{9}$ .22 $\frac{8}{9}$ .89 $\frac{1}{7}$ .14 $\frac{11}{13}$ .85 $\frac{15}{19}$ .79 $\frac{17}{18}$ .94 $\frac{19}{23}$ .83 $\frac{19}{41}$ .46

More Practice

㊹

Annex 0's to the dividend to avoid a remainder:

1.	$\begin{array}{r}9.25\\4\overline{)37.00}\end{array}$	$\begin{array}{r}7.25\\16\overline{)116.00}\end{array}$	$\begin{array}{r}7.76\\25\overline{)194.00}\end{array}$	$\begin{array}{r}18.75\\12\overline{)225.00}\end{array}$	$\begin{array}{r}8.5\\28\overline{)238.0}\end{array}$
2.	$\begin{array}{r}9.375\\8\overline{)75.000}\end{array}$	$\begin{array}{r}3.25\\60\overline{)195.00}\end{array}$	$\begin{array}{r}14.75\\32\overline{)472.00}\end{array}$	$\begin{array}{r}9.16\\75\overline{)687.00}\end{array}$	$\begin{array}{r}2.875\\64\overline{)184.000}\end{array}$
3.	$\begin{array}{r}19.8\\5\overline{)99.0}\end{array}$	$\begin{array}{r}4.875\\48\overline{)234.000}\end{array}$	$\begin{array}{r}35.72\\25\overline{)893.00}\end{array}$	$\begin{array}{r}43.5\\18\overline{)783.0}\end{array}$	$\begin{array}{r}25.16\\25\overline{)629.00}\end{array}$
4.	$\begin{array}{r}11.75\\8\overline{)94.00}\end{array}$	$\begin{array}{r}15.56\\25\overline{)389.00}\end{array}$	$\begin{array}{r}12.875\\56\overline{)721.000}\end{array}$	$\begin{array}{r}9.5\\62\overline{)589.0}\end{array}$	$\begin{array}{r}47.25\\12\overline{)567.00}\end{array}$
5.	$\begin{array}{r}.25\\4\overline{)1.00}\end{array}$	$\begin{array}{r}.875\\24\overline{)21.000}\end{array}$	$\begin{array}{r}.625\\16\overline{)10.000}\end{array}$	$\begin{array}{r}1.45\\68\overline{)98.60}\end{array}$	$\begin{array}{r}1.175\\24\overline{)28.200}\end{array}$
6.	$\begin{array}{r}.875\\8\overline{)7.000}\end{array}$	$\begin{array}{r}.52\\25\overline{)13.00}\end{array}$	$\begin{array}{r}.72\\25\overline{)18.00}\end{array}$	$\begin{array}{r}1.15\\48\overline{)55.20}\end{array}$	$\begin{array}{r}2.42\\25\overline{)60.50}\end{array}$
7.	$\begin{array}{r}.8\\5\overline{)4.0}\end{array}$	$\begin{array}{r}.75\\16\overline{)12.00}\end{array}$	$\begin{array}{r}.625\\48\overline{)30.000}\end{array}$	$\begin{array}{r}1.25\\18\overline{)22.50}\end{array}$	$\begin{array}{r}2.95\\16\overline{)47.20}\end{array}$
8.	$\begin{array}{r}.125\\8\overline{)1.000}\end{array}$	$\begin{array}{r}.74\\50\overline{)37.00}\end{array}$	$\begin{array}{r}.72\\75\overline{)54.00}\end{array}$	$\begin{array}{r}1.65\\54\overline{)89.10}\end{array}$	$\begin{array}{r}.936\\25\overline{)23.400}\end{array}$

㊺

9. Divide by $\frac{9}{10}$:	4 $4\frac{4}{9}$	9 10	6 $6\frac{2}{3}$	$\frac{9}{16}$ $\frac{5}{8}$	$3\frac{3}{4}$ $4\frac{1}{6}$
10. Multiply by $2\frac{1}{4}$:	3 $6\frac{3}{4}$	8 18	14 $31\frac{1}{2}$	$\frac{5}{12}$ $\frac{15}{16}$	$2\frac{2}{3}$ 6
11. Multiply by 1.3:	14 18.2	.17 .221	.07 .091	.2 .26	50 65.0
12. Add $1\frac{1}{6}$ to each:	$\frac{2}{3}$ $1\frac{5}{6}$	$\frac{1}{2}$ $1\frac{2}{3}$	$2\frac{3}{4}$ $3\frac{11}{12}$	$\frac{7}{12}$ $1\frac{3}{4}$	$1\frac{1}{6}$ $2\frac{1}{3}$
13. Find $\frac{5}{8}$ of each:	7 $4\frac{3}{8}$	8 5	$3\frac{1}{5}$ 2	$1\frac{1}{3}$ $\frac{5}{6}$	$1\frac{3}{5}$ 1

㊻

14.	\$3.36 ÷ \$.42 8	\$17.25 ÷ \$.75 23	\$150.67 ÷ \$.61 247
15.	\$2.45 ÷ \$.35 7	\$18.24 ÷ \$.19 96	\$150.08 ÷ \$.28 536
16.	\$7.35 ÷ \$.49 15	\$12.48 ÷ \$.52 24	\$380.23 ÷ \$.47 809
17.	\$4.94 ÷ \$.26 19	\$13.30 ÷ \$.38 35	\$586.15 ÷ \$.95 617
18.	\$3.36 ÷ \$.84 4	\$11.34 ÷ \$.63 18	\$271.60 ÷ \$.56 485
19.	\$9.62 ÷ \$.37 26	\$10.05 ÷ \$.15 67	\$276.36 ÷ \$.84 329

㊼

1. $4.45 ÷ $.05 89 $108.75 ÷ $1.25 87 639.2 ÷ 6.8 94
2. $6.57 ÷ $.09 73 $178.75 ÷ $2.75 65 421.2 ÷ 5.4 78
3. $5.12 ÷ $.08 64 $336.18 ÷ $8.62 39 520.8 ÷ 9.3 56
4. $3.12 ÷ $.06 52 $227.70 ÷ $4.95 46 226.8 ÷ 2.7 84

㊽

If you continue to have a remainder, carry the quotient to two decimal places and round off to the nearest tenth:

5. $\overset{.7}{.3\overline{).22}}$ $\overset{7}{.6\overline{)4.2}}$ $\overset{.5}{.7\overline{).316}}$ $\overset{2.18}{1.5\overline{)3.27}}$ $\overset{1.8}{15.2\overline{)27.6}}$
6. $\overset{.4}{.7\overline{).31}}$ $\overset{6.3}{.3\overline{)1.9}}$ $\overset{2}{.9\overline{).175}}$ $\overset{2.5}{.19\overline{).471}}$ $\overset{22.7}{.007\overline{).159}}$
7. $\overset{.6}{.6\overline{).34}}$ $\overset{2.7}{.9\overline{)2.4}}$ $\overset{.5}{.3\overline{).164}}$ $\overset{.6}{3.1\overline{)1.92}}$ $\overset{63.5}{.043\overline{)2.73}}$
8. $\overset{.5}{.9\overline{).43}}$ $\overset{1.9}{.7\overline{)1.3}}$ $\overset{5.8}{.6\overline{)3.47}}$ $\overset{3.6}{.36\overline{)1.28}}$ $\overset{.2}{1.64\overline{).283}}$
9. $\overset{1.0}{.3\overline{).29}}$ $\overset{8.75}{.4\overline{)3.5}}$ $\overset{1.8}{.7\overline{)1.29}}$ $\overset{1.5}{1.6\overline{)2.43}}$ $\overset{.2}{3.17\overline{).625}}$
10. $\overset{.5}{.7\overline{).33}}$ $\overset{7.25}{.8\overline{)5.8}}$ $\overset{5.3}{.9\overline{)4.73}}$ $\overset{2.8}{1.4\overline{)3.88}}$ $\overset{38.1}{.009\overline{).343}}$

㊾

If you continue to have a remainder, carry the quotient to two decimal places and round it off to the nearest tenth:

11. 27.66 ÷ 3.7 7.5 1.634 ÷ .019 86 6.342 ÷ 3.82 1.7
12. 35.17 ÷ 4.6 7.6 2.437 ÷ .056 43.5 4.293 ÷ 6.15 .7
13. 36.58 ÷ 5.9 6.2 2.123 ÷ .034 62.4 3.667 ÷ 27.4 .1
14. 21.47 ÷ 3.2 6.7 2.065 ÷ .023 89.8 64.27 ÷ 19.6 3.3
15. 19.35 ÷ 2.4 8.1 4.329 ÷ .087 49.8 81.75 ÷ 44.8 1.8
16. 34.19 ÷ 4.3 8.0 3.174 ÷ .036 88.2 7.893 ÷ 32.6 .2
17. 20.47 ÷ 2.6 7.9 2.537 ÷ .029 87.5 4.186 ÷ 5.91 .7

More Practice

(50)

Find these volumes:

1. 4′ × 12′ × 3′ 144 cu. ft. 8″ × 14″ × 6″ 672 cu. in. 9″ × 2′ × 4″ ← $\frac{1}{2}$ cu. ft., or 864 cu. in.
2. 9′ × 21′ × 4′ 756 cu. ft. 6″ × 15″ × 5″ 450 cu. in 6″ × 3′ × 3″ ← $\frac{3}{8}$ cu. ft., or 648 cu. in.
3. 8′ × 16′ × 4′ 512 cu. ft. 9″ × 16″ × 7″ 1008 cu. in. 27″ × 5′ × 2′ ← $22\frac{1}{2}$ cu. ft., or 38,880 cu. in.
4. 7′ × 12′ × 5′ 420 cu. ft. 6″ × 13″ × 4″ 312 cu. in. 24″ × 4′ × $\frac{3}{4}$″ ← $\frac{1}{2}$ cu. ft., or 864 cu. in.

(51)

Add:

5.

2 ft. 4 in.	3 ft. 9 in.	5 hr. 20 min.
7 ft. 2 in.	1 ft. 6 in.	2 hr. 45 min.
4 ft. 3 in.	2 ft. 5 in.	3 hr. 25 min.
13 ft. 9 in.	7 ft. 8 in.	11 hr. 30 min.

6.

2 da. 9 hr.	2 bu. 1 pk.	2 yd. 20 in.
4 da. 8 hr.	1 bu. 2 pk.	3 yd. 27 in.
1 da. 8 hr.	4 bu. 3 pk.	3 yd. 25 in.
8 da. 1 hr.	8 bu. 2 pk.	10 yd.

Subtract:

7.

8 lb. 12 oz.	9 qt.	8 da. 12 hr.
2 lb. 9 oz.	3 qt. 1 pt.	6 da. 20 hr.
6 lb. 3 oz.	5 qt. 1 pt.	1 da. 16 hr.

8.

6 lb. 4 oz.	4 ft. 9 in.	3 da. 4 hr.
3 lb. 8 oz.	3 ft. 11 in.	1 da. 20 hr.
2 lb. 12 oz.	10 in.	1 da. 8 hr.

(52)

9. 95% of 80 76 3% of 200 6 16% of \$29 ← \$4.64 43% of \$182 \$78.26
10. 35% of 40 14 1% of 700 7 23% of \$12 ← \$2.76 98% of \$107 \$104.86
11. 80% of 85 68 7% of 900 63 67% of \$86 ← \$57.62 17% of \$625 \$106.25
12. 60% of 75 45 6% of 750 45 84% of \$49 ← \$41.16 21% of \$833 \$174.93

Number Facts. In the early part of Grade 6 the pupils should be given the tests on pages 6, 11, 14, and 22 to see how well they know fundamental number facts. A lack of mastery of any one or more of these facts may handicap a pupil's progress in arithmetic. Teachers should make every effort to discover the particular facts that each child has not mastered and see to it that extra study is given to them. Facts with answers are given on pages 306–309.

The tests just mentioned are to be given orally to each individual pupil. As the pupil reads each fact on any given test, he gives *only the answer*. He should not say "4 times 8 equals 32" but only "32." When the pupil takes one of these oral tests, the teacher should note all the facts for which the pupil gives unsatisfactory responses. At the end of the test the teacher should give the pupil a list of these particular facts, with instructions to study them carefully. An unsatisfactory response is one that is incorrect or that is given with much hesitation, even though it is correct.

The time limit for each test is 3 to $3\frac{1}{2}$ minutes, depending upon the ability of the pupil and the part of the school year in which the test is given. If more time is required, it means that there are many facts which the pupil has not mastered. In giving each test it is as important to discover the delayed responses, even though they are correct, as it is to locate the incorrect ones. Written tests on the basic facts are not as satisfactory as oral tests since written tests do not indicate the delayed, though correct, responses. If the answers to the facts are written, the time should be extended to 5 or 6 minutes.

Number Relationships. Certain helps are included in this book to remedy defects in the mastery of the fundamental number facts. By this means the pupil is enabled to help himself when he forgets the answer to any fact. These helps are not a substitute for the memorization of the number facts; their sole purpose is to provide an easy way to get the correct answer to a fact that has been forgotten. It is expected that after using these helps a short time the pupil will then remember the correct answer. Pages 7 and 12 show ways the pupil can help himself to get the answer to an addition or a subtraction fact if he has forgotten it. Important aids in the learning of the multiplication facts are given on pages 14, 20, and 21. Page 23 shows how the multiplication facts are used to aid in learning the division facts. Number relationships teach the pupil to relate unknown facts to those he already knows and by this means reduce the amount of learning necessary to master the 390 fundamental number facts.

Improvement Tests. The timed tests described on pages 54 to 58 are called Improvement Tests. There are 60 of these tests in this book. The purpose of these tests is to keep alive and to perfect the computational skills with whole numbers that the pupils have learned previously, and to accomplish this task in a comparatively few minutes each week, so that ample time is left in each class period for the study of new topics. The procedure in giving these tests is described below and on pages 54 to 58. For a complete list of the pages upon which Improvement Tests appear, see the Index of this book.

How to Give Improvement Tests. The Improvement Tests are arranged in sets, each set containing three tests of the same kind and of equal difficulty. See the set of three addition tests on page 55. The procedure in giving a test, such as Addition Test 1a on page 55, is as follows:

(1) Start all the pupils at the same time by saying "Go." Stop all pupils promptly at the end of 5 min., which is the time assigned for this Addition Test. Use a watch with a second hand to keep the time. For addition and subtraction tests the answers should be written along the edge of a sheet of folded paper, as described on page 56.

(2) Read the answers. Then have each pupil count the number of exercises he has right and find his score on a scale of 10, using the Scoring Table on page 329. A partially completed exercise does not count.

(3) The pupil should keep a graphic record of his scores on these tests as described on page 58.

Never give more than one test of a set per day. For example, if Addition Test 1a, on page 55, is given today, Addition Tests 1b and 1c should be given on subsequent days. In general, give 1 set (3 tests) at most per week. There are 20 sets (60 tests) in all; to distribute these tests uniformly over the school year, it is suggested that two sets be given every three weeks, which is an average of one set (3 tests) every $1\frac{1}{2}$ weeks. After a little practice a test can be taken, scored, and recorded within 10 minutes.

The time allowed for each test is a reasonable one. If the pupil has had sufficient practice in the fundamental operations, he should have no trouble in completing the test in the assigned time. It is important that each test of a set be given exactly the same amount of time; otherwise there will be no dependable means of knowing whether the pupil is improving or not.

The graphic record of scores, which each pupil keeps, enables him quickly to see whether his skill is improving. This record also makes it possible for the pupil to compare his skill in addition with that in subtraction or multiplication, thus showing him the operation upon which he needs the most practice.

The writing of answers on folded paper applies only to tests on addition and subtraction. For tests on multiplication and division, the exercises should be copied on a sheet of paper *before* the test is given. In copying the exercises the pupil should spread them over the sheet to allow ample space for the work.

Suggestions to Teachers

More Practice. Pages 310–326 of this book give supplementary practice material that can be used in several ways as the teacher sees fit. References to these sets of exercises have been made on certain pages of the text where it is possible that more practice of a given type may be needed. The teacher can decide when to use this material. The supplementary exercises can also be used for the purpose of review on any given topic where review is desired.

Additive Method of Subtraction

This section is for teachers who use the additive method of subtraction. The basic idea of additive subtraction is to find a number to add to the lower number (subtrahend) to make the top number (minuend). Borrowing is not required in this method and for that reason the additive method is often easier for pupils to learn than the take-away method. The number of the page where subtraction of whole numbers is taught is given below. The model example is explained by the additive method of subtraction.

Page 12. You have learned that you can subtract 185 from 314 by adding enough to 185 to make 314. Think, "5 + 9 = 14." Write 9 in ones place. Add 1 ten to 8 tens, making 9 tens. Think, "9 + 2 = 11." Write 2 in tens place. Add 1 hundred to 1 hundred, making 2 hundreds. Think, "2 + 1 = 3." Write 1 in hundreds place. Check by adding 129 to 185 to see if the sum is 314.

314 Minuend
185 Subtrahend
129 Remainder

SCORING TABLE FOR IMPROVEMENT TESTS

NUMBER OF EXAMPLES IN TEST	NUMBER OF EXAMPLES RIGHT															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
4	0	3	5	8	10											
5	0	2	4	6	8	10										
6	0	2	3	5	7	8	10									
7	0	1	3	4	6	7	9	10								
8	0	1	3	4	5	6	8	9	10							
9	0	1	2	3	4	6	7	8	9	10						
10	0	1	2	3	4	5	6	7	8	9	10					
12	0	1	2	3	3	4	5	6	7	8	8	9	10			
15	0	1	1	2	3	3	4	5	5	6	7	7	8	9	9	10

For directions for using this table, see page 57.

Index

Accounts, cash, 45–47
  savings, 284, 285
Acre, 114
Addends, 8
Addition, by endings, 7
  checking, 8, 9
  helps in, 7
  of decimals, 128, 129, 192, 284, 285
  of dollars and cents, 10, 46, 47, 72, 146, 167, 192
  of fractions, 62–65, 75, 76
  of two-unit measures, 258–261
  of whole numbers, 8–10, 53, 284
  one hundred facts in, 6, 306
  terms used in, 8
  zero in, 14
Annexing zero, 131, 201–203
Area of a rectangle, 111, 244, 245
Averages, 29–35

Balance, 45
Bar graphs, 28, 144, 145, 265
Billions, 4
Bills, 242, 243

Cancellation, 103–105, 109
Century, 305
Common denominator, 75–77
Commutative principle, 7
Comparing numbers, 184–186
Cube, 246
Cubic measure, 246–250

Decimal point, 88, 90, 120, 121
  practice in placing, 126, 153, 229, 295
Decimals, addition of, 128, 129, 192, 284, 285
  changing fractions to, 120, 210, 211
  changing to fractions, 135
  division of, 200–203, 208, 220–222, 225–227
  ending in fractions, 136, 202
  meaning of, 120–124
  mixed, 120
  multiplication of, 147–153, 287
  reading and writing, 120–122
  rounding off, 207, 208, 211, 254–256, 283
  subtraction of, 130, 131, 192, 288
  zero in, 128, 131, 132, 201, 225
Denominator, 59
  common, 75
  least common, 75–77
Diagnostic tests, in decimals, 159, 232, 303
  in fractions, 84, 118, 160, 196, 302
  in measures, 270, 302, 303
  in whole numbers, 6, 11, 15, 22, 42, 159, 196
Difference, 12
Dimensions, 96
Dividend, 24
Divisibility, tests of, 163
Division, by 10, 100, 1000,—218
  checking, 24, 29, 165, 220, 221
  how multiplication helps, 23
  ninety even facts in, 22, 309
  of decimals, 200–203, 208, 220–222, 225–227
  of dollars and cents, 136, 169, 201, 202, 210, 218
  of fractions, 171–175, 178–181
  of whole numbers, 23–26, 29–36, 165, 166, 168, 169, 299
  remainder in, 24
  short, 24–26
  terms used in, 24
  uneven facts in, 23
  with one-figure divisors, 23–26
  with three-figure divisors, 165, 166, 168, 169
  with two-figure divisors, 29–35
  zeros in, 35, 169, 225
Divisor, 24
  inversion of, 172, 173
Dollars and cents, addition of, 10, 46, 47, 72, 146, 167, 192
  division of, 136, 169, 201, 202, 210, 218
  multiplication of, 16, 72, 88, 90, 91, 98, 147, 217
  rounding off, 292
  subtraction of, 46–48, 72, 127, 132, 133, 192, 223
Dry measure, 305

Estimating answers, 149, 153, 228, 229

Facts with answers, 306–309
Folded paper, use of, 8, 56, 328
Fractional parts, 87–91
Fractions, addition of, 62–65, 75, 76
  changing decimals to, 135
  changing to decimals, 120, 210, 211
  changing to lowest terms, 60, 61, 164

Fractions (continued)
  division of, 171–175, 178–181
  equal, 59, 60
  improper, 61, 108
  in quotients, 26, 164, 166
  meaning of, 59
  multiplication of, 87–93, 100–105, 109, 110
  proper, 61
  readiness work in, 68, 101, 171
  subtraction of, 66, 68–71, 77
  terms of, 59

Graphs, bar, 28, 144, 145, 265
  line, 58, 214, 215, 265, 296
  picture, 264, 265

Hundredths, 121

Improvement Tests, how to take, 54, 56
  in addition, 55, 107, 167, 213, 263
  in division, 95, 139, 199, 251, 291
  in multiplication, 74, 139, 199, 237, 291
  in subtraction, 67, 127, 183, 223, 277
  keeping records in, 58
  scoring, 57, 329
Interests of pupils, airplanes and automobiles, 4, 10, 13, 17, 29, 31, 33, 34, 130, 134, 138, 141, 148, 149, 151, 158, 164–166, 169, 195, 202, 209, 212, 222, 228, 231, 252, 254–256, 265, 267, 269, 277, 284–286, 288, 289, 293, 301
  buying, 10, 13, 18, 38, 41, 48, 62, 63, 65, 72, 73, 81–83, 88–91, 106, 116, 117, 129, 136, 138, 142, 143, 147, 158, 178, 188, 190, 191, 194, 195, 200–202, 206, 210, 216, 218, 220, 221, 225, 227, 228, 245, 252, 259, 275–277, 286, 289, 290, 293, 296, 301
  clubs, 32, 35, 45, 78, 90, 119, 170, 195, 220, 221, 267, 301
  making things, 24, 37, 49, 60, 63, 65, 66, 72, 88, 92, 97, 100, 102, 104, 106, 108, 110, 117, 158, 171, 174, 175, 179, 185, 195, 206, 247, 248, 259, 276, 288, 289, 296, 298
  parties, picnics, trips, 10, 13, 16, 18, 26, 31, 33, 41, 48, 63, 69, 81, 93, 132, 138, 148, 170, 181, 209, 212, 219, 222, 228, 286, 298
  saving, 38, 39, 49, 73, 83, 143, 184, 188, 206, 267, 276, 282, 283, 288
  school, 10, 13, 17, 18, 24, 26, 30, 41, 73,

Interests of pupils, school (continued) 83, 93, 106, 116, 130, 132, 144, 155, 158, 169, 195, 206, 225, 227, 231, 245, 248, 250, 252, 264, 283, 285
  selling, 10, 16, 37, 38, 79, 83, 144, 158, 186, 187, 191, 217, 219, 220, 228, 231, 277, 289, 293, 296
  working and earning, 18, 38, 39, 46, 47, 49, 60, 63, 72, 73, 78, 79, 81, 88, 102, 110, 117, 119, 138, 151, 190, 228, 258, 269, 298

Length, measures of, 94
Line graphs, 58, 214, 215, 265, 296
Liquid measure, 305

Magic circles, 142
  squares, 133, 257
  stars, 142
Measures (*see* **Tables**)
Millions, 4
Minuend, 12
Mixed number, 61, 108
Mixed practice, 74, 98, 139, 146, 154, 189, 213, 224, 237, 263, 268, 297
Multiplicand, 15
Multiplication, by 10, 100, 1000,—217
  checking, 15–17
  facts in, 14, 15, 20, 21, 308
  helps in, 20, 21
  of decimals, 147–153, 287
  of dollars and cents, 16, 72, 88, 90, 91, 98, 147, 217
  of fractions, 87–93, 100–105, 109, 110
  of whole numbers, 15–17, 137
  terms used in, 15
  zeros in, 14, 17
Multiplier, 15

Numbers, comparing, 184–186
  even and odd, 163
  meaning of, 4
  mixed, 61, 108
  reading and writing, 4, 5
  Roman, 19, 123
  rounding off, 27, 207, 208, 211
Numerator, 59

Partial products, 15
Per cent, 273–276, 283
Perimeter, 96, 97
Place value, 4, 5, 120–123, 136
Practice pages, extra, 310–326
Problem solving, helps in, 48, 72, 184–186, 276

Problem tests, 41, 83, 117, 158, 195, 231, 269, 301
Problems, in decimals, 125, 126, 134, 148, 151, 202, 205, 209, 212, 222, 227, 254-256, 284
  in fractions, 60, 63, 65, 71, 78, 80, 88, 91, 102, 110, 170, 175, 179, 181, 188, 275
  mixed, 1-3, 18, 38, 41, 43, 44, 48-52, 72, 73, 79, 83, 85, 86, 106, 117, 119, 138, 143, 158, 161, 162, 176, 177, 190, 195, 197, 198, 228, 231, 233-236, 267, 269, 276, 277, 280, 281, 285, 286, 289, 293, 296, 297, 301
  on measures, 37, 94-97, 112, 115, 191, 219, 245
  three-step, 72, 73, 276, 277
  two-step, 48, 49, 276, 277
  with extra data, 81, 190, 298
  with missing data, 141
  without numbers, 155, 287
  without questions, 39, 206
Product, 15
Projects, 1-3, 43, 44, 50-52, 71, 79, 85, 86, 90, 91, 119, 161, 162, 176, 177, 181, 185-187, 197, 198, 205, 209, 233-236, 240, 250, 254-256, 260, 261, 271-273, 280, 281

Quotient, 24

Receipts, 241-243
Rectangle, 96, 111
Rectangular solid, 246-250
Relationships, number, 14, 20, 21, 23
Remainder, in division, 24
  in subtraction, 12
Remedial practice, 310-326
Reviews, chapter, 40, 82, 116, 157, 194, 230, 268
  oral, 36, 156, 193, 278, 292, 300
  written, 36, 53, 74, 78, 80, 98, 106, 140, 146, 154, 170, 182, 189, 192, 213, 216, 224, 237, 252, 253, 263, 266, 267, 275, 284-286, 288-290, 293, 296, 297, 299
Right angle, 111
Rod, 94
Roman numerals, 19, 123
Rounding off numbers, 27, 207, 208, 211

Sales slip, 90
Scale drawing, 238-240, 244, 262, 273
Solid, rectangular, 246-250
Square, 111
Square measure, 111-114
Subtraction, additive method, 329
  checking, 12
  helps in, 14
  how addition helps, 12
  of decimals, 130, 131, 192, 288
  of dollars and cents, 46-48, 72, 127, 133, 192, 223
  of fractions, 66, 68-71, 77
  of whole numbers, 11-13, 53
  one hundred facts in, 11, 307
  terms used in, 12
  zero in, 12
Subtrahend, 12
Suggestions to teachers, 327-329
Sum, 8

Tables, of cubic measure, 248, 305
  of dry measure, 305
  of linear measure, 94, 305
  of liquid measure, 305
  of square measure, 114, 305
  of time, 305
  of weight, 219, 305
Tenths, 121
Tests, diagnostic, 6, 11, 15, 22, 42, 84, 118, 159, 160, 196, 232, 270, 302, 303
  improvement, 55, 67, 74, 95, 107, 127, 139, 167, 183, 199, 213, 223, 237, 251, 263, 279, 291
  problem, 41, 83, 117, 158, 195, 231, 269, 301
  promotion, 304
Thousands, 4
Thousandths, 121
Time, measures of, 271, 272, 305
Twenty-four-hour clock, 271-272

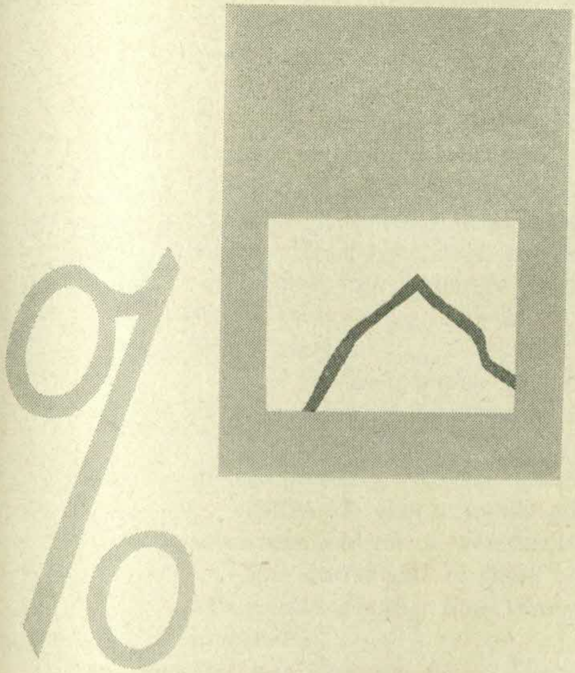
Vocabulary exercises, 99, 107, 167, 204, 251, 294
Volume, finding, 246-250

Weight, measures of, 219

Zero, as a place holder, 123
  in addition, 14
  in division, 35, 169, 225
  in multiplication, 14, 17
  in subtraction, 12

Teacher's Guide and Key for

BROADENING KNOWLEDGE



American Arithmetic
Second Edition
Grade 6

CLIFFORD B. UPTON
KENNETH G. FULLER

$a \times b = b \times a$

AMERICAN BOOK COMPANY
New York Cincinnati Atlanta Dallas Millbrae

Copyright © 1963 by American Book Company

Philippines Copyright 1963 by American Book Company

Upton-Fuller: *Teacher's Guide and Key for American Arithmetic, Second Edition, Grade 6, Broadening Knowledge.* Manufactured in the United States. All rights reserved. Certain portions of this work copyright © 1960 and 1957 by American Book Company. No part of this book protected by the copyrights hereon may be reproduced in any form without written permission of the publisher.

EP 10 9 8 7 6 5 4 3 2 1

Introduction

Use of This Guide. This Guide, together with the Upton-Fuller *American Arithmetic, Second Edition, Grade 6, Broadening Knowledge,* offers to the teacher a course in modern methods of teaching arithmetic in Grade 6. The Guide presents the principles of teaching, while *American Arithmetic, Grade 6* illustrates these principles through the actual materials of instruction. This combination provides a more comprehensive discussion of methods in arithmetic than is found in the usual methods book.

The Guide gives suggestions and helps on the teaching of each page of *American Arithmetic, Grade 6* and often refers to specific exercises in the text. To use the Guide successfully, you should study carefully each text exercise or explanation to which reference is made in the Guide.

Since a thorough acquaintance with a textbook helps the teacher in using that textbook effectively, certain outstanding features of this series of books, and of *American Arithmetic, Grade 6* in particular, are given below.

Philosophy Underlying These Books. The objectives of *American Arithmetics* are simply stated:

(1) To teach pupils properly to interpret and to solve the problems of everyday life that involve quantitative data

(2) To teach pupils to understand our number system and the four fundamental processes with whole numbers, fractions, and decimals

(3) To develop in pupils sufficient skill in computation to enable them to solve the problems of everyday life with reasonable speed and accuracy

The attainment of these objectives comes *through insight and intelligent understanding* rather than through the blind following of rules and mechanical procedures.

Meaning and Understanding. Meaning and understanding in arithmetic go much farther than using objects in the primary grades to make numbers meaningful, or explaining the process of carrying in addition. Meaning and understanding, properly treated, must pervade all the work in arithmetic throughout the elementary school. The constant aim of this series of texts is to teach arithmetic so that the pupils understand and enjoy it. Throughout these books special attention is given to the following:

1. Basic Concepts and Terms of Arithmetic. The meaning of fundamental concepts relating to whole numbers, fractions, and decimals, as well as the definitions of the technical terms of arithmetic, are explained with unusual clarity.

2. Comprehension of the Fundamental Processes. This feature includes clear explanations of such topics as the addition of unlike fractions, the division of a fraction by a fraction, the division of a decimal by a decimal, and so on.

3. Meaningful Processes through Motivating Problems. In these arithmetics each new topic or process is made meaningful through a motivating problem related to the interests of the pupils. This method shows why the new process is needed.

4. Fundamental Principles. Fundamental principles of arithmetic are simply explained and applied throughout this series of books. These principles replace arbitrary rules.

5. Meaningful Problems. All problems and projects relate to the interests and experiences of children and are written in language that they can understand.

6. Our Number System. The principles underlying our number system are emphasized in each book of this series.

Number Relationships. The fundamental number facts in addition, subtraction, multiplication, and division are the *foundation stones* of all arithmetic. These facts are supposed to be learned in Grades 3 and 4, but in every school one still finds in Grades 5 through 8 pupils who are not sure that 8 and 9 are 17 or that 7 times 9 equals 63. Defects like these are a serious hindrance to all the subsequent work in arithmetic.

In an attempt to remedy this situation, *American Arithmetics* taught the fundamental number facts in Grades 3 and 4 by the use of number relationships. The procedure by which this teaching was accomplished is fully explained in *American Arithmetic, Grade 3* and *American Arithmetic, Grade 4*, and also in the *Teacher's Guides* for these two grades. You should refer to this work particularly for suggestions on remedial work for the addition and subtraction facts. For remedial work on the multiplication and division facts, for which there is usually a greater need, you should study the interesting new number relationships which are presented on pages 20, 21, and 23 of *American Arithmetic, Grade 6*. The pupils will find these relationships a delightful arithmetic recreation as well as a very effective aid in memorizing the facts they do not know.

Long Division. Long division is by far the most difficult topic with whole numbers. The term *long division* refers to examples in which the divisor is a number of two or more figures. Long division with 2-figure divisors was taught in detail in *American Arithmetic, Grade 5* and is fully reviewed in *American Arithmetic, Grade 6*. Long division with 3-figure divisors is introduced in Grade 6.

In most textbooks long division is taught by a method which requires frequent correction of each quotient figure before the correct figure is found. An example of this inefficient way of doing long division is described below in Method A:

Method A. In the work at the right, each quotient figure is found by dividing each partial dividend by the *first figure of the divisor*. For example, to find the first quotient figure, you divide 9 by 2, which gives 4 as a trial quotient. Since 4 is too large, you then try 3, which is correct. To get the next quotient figure, you divide 13 by 2, getting 6, which is too large. You try 5, which is also too large. Then you try 4, and that is correct. For the next quotient figure you divide 21 by 2, which gives 10; but no quotient figure can be larger than 9, so you try 9. You find that 9 is too large, so you try 8; 8 is also too large, so

$$\begin{array}{r} 347 \\ 28\overline{)9734} \\ \underline{84} \\ 133 \\ \underline{112} \\ 214 \\ \underline{196} \\ 18 \end{array}$$

you try 7, which is correct. It should be noted that the correct quotient figure was obtained each time *only after two or three trials.*

By contrast, in *American Arithmetic, Grade 5,* and also in *American Arithmetic, Grade 6,* the pupils are taught to do the example as shown in Method B:

Method B. Instead of dividing each partial dividend by 2, divide in each case by 3, which is 1 *more than the first figure of the divisor.* In other words, you think of 28 as being close to 30; hence, you get each trial quotient figure by dividing by 3 instead of 2. To get the first quotient figure, divide 9 by 3; this gives 3, which is correct. To get the second quotient figure, divide 13 by 3; this gives 4, which is correct. To get the next quotient figure, divide 21 by 3; this gives 7, which is correct. By following this method, you see that the correct quotient figure is found each time *on the first trial.*

In the example shown, the divisor is 28. In the Upton-Fuller *American Arithmetics,* if the divisor were 26, 27, or 29 instead of 28, the example would be worked also by Method B, because each of these divisors is closer to 30 than to 20. In fact, for any 2-figure divisor having a second figure of 6, 7, 8, or 9, each quotient figure is estimated by dividing by 1 more than the first figure of the divisor. See page 32 of *American Arithmetic, Grade 6.* On the other hand, if the second figure of a 2-figure divisor is 1, 2, 3, 4, or 5, each quotient figure is estimated by dividing by the first figure of the divisor. See page 29 of *American Arithmetic, Grade 6.* It is thus seen that with the method of long division taught in the Upton-Fuller *American Arithmetics,* each quotient figure is found by dividing by the *first figure* of the divisor when the divisor ends in 1, 2, 3, 4, or 5, and by dividing by 1 *more than the first figure* when the divisor ends in 6, 7, 8, or 9. This method of long division is very efficient since it gives the correct quotient figure *on first trial* in 80% of all cases; in the remaining 20% of cases, with minor exceptions, the correct quotient figure is found after a single correction. In other words, the necessity of correcting each quotient figure several times does not occur when long division is taught according to the method given in the Upton-Fuller *American Arithmetics.* This method of long division is the result of years of research on the part of Professor Upton. The research was reported in detail in the *Tenth Yearbook of the National Council of Teachers of Mathematics* in an article entitled "Making Long Division Automatic."

Problem Solving and Projects. The problems in *American Arithmetic, Grade 6* stress problems of two or more steps and are related to the interests of boys and girls. There are many helps on problem solving. See pages 39, 48, 72, 81, 141, 155, 190, and so on.

Also provided are many challenging projects in which arithmetic is correlated in interesting ways with history, geography, science, agriculture, and transportation. See pages 1–3, 43–44, 50–52, 79, 85–86, 119, 161–162, 197–198, 233–235, 239, and so on.

Vocabulary and Language. Problems and explanations are written in simple language that children can understand. The vocabulary has been controlled with unusual care and contains a very high percentage of words given in authoritative word lists as suitable for Grade 6. The technical words of arithmetic are clearly defined and are reviewed in special exercises; see pages 8, 12, 15, 24, 59, 61, 75, 99, and so on.

Maintenance Program. Full provision has been made to maintain skills in computation and problem solving as follows:

1. **Reteaching of Important Topics.** Each book in this series devotes the first one or two chapters to a review and a reteaching of the important topics in the work of the preceding year.

2. **Diagnostic Tests.** Diagnostic tests with keyed references to remedial exercises are given at the end of each chapter. See pages 42, 84, 118, 159, 160, 196, 232, 270, 302, and 303.

3. **Problem Tests.** A Problem Test designed to test the pupil's ability in problem solving is given in each chapter. See pages 41, 83, 117, 158, 195, 231, 269, and 301.

4. **Chapter Reviews.** Reviews covering the new work of each chapter are provided. See pages 40, 82, 116, 157, 194, 230, and 268.

5. **Oral and Written Reviews.** Reviews covering important topics previously taught are frequently given. For examples, see pages 7, 8, 36, 53, 80, 134, 140, 156, 182, 216, 252, 253, 282, 299.

6. **Improvement Tests.** A series of 60 Improvement Tests, covering the four operations with whole numbers, is distributed over the year's work. These tests provide a most efficient and interesting means of maintaining skills with whole numbers while the pupil is studying new topics. See pages 55, 67, 74, 95, 107, 127, 139, 167, 183, 199, 213, 223, 237, 251, 263, 277, and 291.

7. **Mixed Practice.** Computational practice on the four fundamental processes is amply provided for. See, for example, pages 98, 146, 154, 189, 213, 237, and 297.

8. **Maintenance of Arithmetic Vocabulary.** Reviews which give an opportunity to check understanding of words essential to arithmetic are provided. See pages 99, 107, 167, 204, 251, and 294.

Use of the Textbook. Before starting the year's work, read "Suggestions to Teachers" on pages 327–329 of *American Arithmetic, Grade 6*. These suggestions contain valuable teaching hints and give various helps for teaching specific pages of the text.

In teaching *American Arithmetic, Grade 6*, you will find that it is important to follow the textbook, page by page, as it is written. Do not skip around in the book, teaching the topics in a different order from that in which they are now presented. The reason for this caution is that arithmetic is a *sequential subject:* each topic must be taught in its proper order because of the close dependence of the various topics one upon another. For example, the addition of fractions with like denominators must precede addition of fractions with unlike denominators, the multiplication of fractions must come before the division of fractions, square measure must come before cubic measure, and so on. Teaching the successive topics in arithmetic is much like forging the links of a chain. If one of the links is defective, the chain breaks. If a child is absent from school when a certain topic is taught, he may be greatly handicapped when he returns to school, since the topic he missed may be essential to his understanding of the new work he is about to take up.

This emphasis on the importance of presenting the topics in their sequential order applies with particular force to arithmetic. Other school subjects, such as history, English, and geography, are not so highly sequential in nature as arithmetic. In geography, for example, if a pupil is absent from school when a study of the New England States is made, this absence does not handicap him in his study of the North Central States when he returns to school. On the other hand, the same absence from school may seriously affect his progress in arithmetic.

The fact that arithmetic is a sequential subject makes it very important for you to try to learn *at frequent intervals* the difficulties that each pupil is having, rather than to let these difficulties accumulate. By the aid of the diagnostic tests and other tests given in the textbook, find out each pupil's difficulties as the work progresses and take the necessary steps to correct them. This diagnostic work is especially necessary in the sixth grade because by the end of this grade the pupil has completed the four fundamental processes with whole numbers, fractions, and decimals. With so many different skills to be kept straight, it is an easy matter for difficulties to arise.

Key. All answers are given on the appropriate pages in the Guide. These answers will be a convenience for those teachers not using the annotated edition, who may prefer to transfer them to the textbook pages for ready reference. As a further convenience, two-part and three-part examples are worked out throughout the book.

Chapter 1

Aims of Chapter 1. The major aim of Chapter 1 is to review skills and understandings taught in previous grades. The specific aims of Chapter 1 are to:

1. Review basic addition facts and the steps in the process of addition, including 4-column addition with 4 addends.
2. Review basic subtraction facts and the steps in the process of subtraction, including 5-digit numbers with regrouping and zeros in the minuend.
3. Review basic multiplication facts and the steps in the process of multiplication, including 3-figure multipliers.
4. Review basic even and uneven division facts and the steps in the process of division, including 2-figure divisors involving both Rule I and Rule II.
5. Reteach short division with 1-figure divisors.
6. Review adding by endings.
7. Review the relationships which exist between certain addition and subtraction facts.
8. Review the relationships which exist between multiplication and division facts.
9. Restudy Roman numerals through thousands.
10. Extend the reading of large numbers and the meaning of place value through hundred billions.
11. Reteach the rounding off of large numbers.
12. Reteach the reading and construction of bar graphs.
13. Review simple measures.
14. Review problem solving including two-step problems.

Pages 1–3

Aim: To review problem solving in an interesting project relating to the history of our country

Suggestions: This project on the Lewis and Clark Expedition is the result of detailed research on the part of the authors; hence, the historical data are authoritative. Great care is required to prepare a project of this kind so that the arithmetic involved in solving each problem is of a level of difficulty suitable for pupils of the sixth grade. This project shows how arithmetic can aid in the interpretation and appreciation of an important historical event.

A wide variety of arithmetic skills, such as the following, is reviewed in this problem unit:

a. Finding a fractional part of a number
b. Calculating time
c. Estimating daily rate of travel
d. Using numerous basic skills in fundamental operations dealing with whole numbers

Key: Page 1 **1.** $\frac{1}{4} \times \$2500 = \$625$. **2.** 170 da. **3.** $9 \times 170 = 1530$ (mi.), $10 \times 170 = 1700$ (mi.); 9 mi. a day is closer.

Pages 2–3 **1.** 23 da. + 31 da. + 30 da. + 25 da. = 109 da. **2.** 15 da. + 7 da. = 22 da. **3.** (1) $11 \times 214 = 2354$ (mi.), $12 \times 214 = 2568$ (mi.), about 12 mi. a day; (2) 1600 mi. + 2534 mi. = 4134 mi. **4.** 8 da. + 30 da. + 31 da. + 30 da. + 31 da. + 31 da. + 23 da. = 184 da. **5.** $33 \times 320 = 10{,}560$ (acres).

Pages 4–5

Aim: To extend the meaning of numbers through hundred billions

Suggestions: Place great emphasis on the use of commas to group the "periods" within a large number (see ex. 4, page 4). The place-value diagram in ex. 9, page 4, should be placed on the blackboard or on the bulletin board for ready reference. Pupils may be encouraged to open their new social-studies books and look for large numbers similar to those listed in ex. 2 and 3 on page 5. Many teachers may wish to make an assignment similar to that found in ex. 11 on page 5 and use the bulletin board for a class report on this research project.

Some pupils will have great difficulty in understanding the meaning of the words *million* and *billion.* Although an understanding cannot be brought to the class by means of objects or diagrams, stories similar to the following may help:

A man who wanted to see what a million dollars looked like went to a bank and asked for a million new one-dollar bills. Outside the bank he decided to put these bills in one pile. He did, with the help of some tall ladders; and the pile of one-dollar bills went up into the air to the height of 280 feet, or the height of a 25-story office building!

Now if he had wanted to see what a *billion dollars* would look like, he would have had to pile the dollar bills to a height of over 280,000 feet, or about 53 miles!

If you do not want to ask a bank for such amounts of money, but you still want to know what a million or a billion is, you can try this activity:

Start counting out loud, "1, 2, 3, 4 . . ." and count at the rate of 100 per minute. Keep counting for 10,000 minutes ($166\frac{2}{3}$ hours or nearly 7 full days). Be sure to keep counting without stopping to do anything else such as eat, sleep, drink, or rest. At the end of $166\frac{2}{3}$ hours you will have counted to *one million.*

Now if you want to go on and count to a billion, plan to spend about 7000 days or over 19 years at this task without stopping to eat, sleep, or drink. Then you will have counted to a billion!

Key: Page 4 **1.** 2 hundreds, 1 ten, 4 ones; 2 thousands, 5 hundreds, 3 tens, 4 ones. **2.** 2 ten-thousands, 3 thousands, 8 hundreds, 3 tens, 5 ones. **3.** 1 hundred-thousand, 2 ten-thousands, 3 thousands, 5 hundreds. **9.** 2 hundred-billions, 8 ten-billions, 1 billion, 3 hundred-millions, 7 ten-millions, 2 millions, 6 hundred-thousands, 4 ten-thousands, 0 thousands, 3 hundreds, 5 tens, 7 ones. **10.** 63,593,221, 63 million, 593 thousand, 221; 4,882,935, 4 million, 882 thousand, 935; 293,645,707, 293 million, 645 thousand, 707; 8,539,645,279, 8 billion, 539 million, 645 thousand, 279; 321,456,035,232, 321 billion, 456 million, 35 thousand, 232; 7,543,007, 7 million, 543 thousand, 7.

Page 5 **1.** 70 million, 821 thousand. **2.** 7 million, 781 thousand, 984; 3 million, 550 thousand, 404; 2 million, 2 thousand, 512; 750 thousand, 26; 697 thousand, 197; 532 thousand, 759; 471 thousand, 316; 313 thousand, 411. **3.** (1) Calif.: 5 billion, 678 million; Minn.: 3 billion, 552 million; Mo.: 1 billion, 701 million; Pa.: 3 billion, 488 million; Ohio: 2 billion, 471 million; Iowa: 4 billion, 732 million; Ill.: 2 billion, 397 million; Ind.: 2 billion, 515 million; (2) California. **4.** 4,320,600. **5.** 15,011,009,060. **6.** 635,400,000. **7.** 7,000,015,930. **8.** 50,809,024. **9.** 180,290,019,046. **10.** 12,513,817.

Page 6

Aim: To test the pupils' mastery of the 100 addition facts

Suggestions: The 100 addition facts are probably the most used of all the number facts in arithmetic. These facts are supposed to have been learned thoroughly by the end of the third grade. You will find, however, that some pupils in the sixth grade have not fully mastered all these facts and that they continue to make mistakes in using them. One of the important things for you to do at the beginning of the sixth grade is to determine how well the pupils know these facts. This check can best be made by testing each pupil orally with reference to these facts. For suggestions for making such tests, see page 327 of the text.

You may prefer to make the oral tests on the 100 addition facts by means of flash cards, each card containing one fact. After you show a card to a pupil and obtain his response, place the card in one of three piles according to whether the response is satisfactory, delayed, or incorrect. The pupil is then instructed to practice on the cards in the "delayed" and "incorrect" piles. It is just as important to discover the delayed responses, even though they be correct, as it is to locate the incorrect ones, since a delayed correct response suggests that the pupil may be counting to get the answer.

Key: **1.** 4; 12; 17; 8; 9; 8; 13; 4; 11; 12. **2.** 6; 10; 4; 5; 8; 12; 3; 11; 16; 8. **3.** 7; 7; 8; 11; 1; 9; 10; 6; 15; 11. **4.** 13; 9; 15; 13; 9; 16; 11; 2; 3; 14. **5.** 3; 10; 5; 10; 8; 7; 5; 12; 2; 4. **6.** 13; 6; 7; 9; 13; 5; 8; 14; 9; 17. **7.** 12; 3; 11; 10; 9; 14; 7; 14; 5; 4. **8.** 9; 13; 5; 9; 8; 6; 7; 1; 15; 8. **9.** 2; 6; 18; 7; 12; 7; 15; 10; 16; 10. **10.** 10; 10; 11; 0; 6; 6; 12; 9; 11; 14.

Page 7

Aims: To review number relationships; to review adding by endings

Suggestions: A thorough understanding of number relationships in the four arithmetical processes is an invaluable aid to the pupil, a necessity in advanced mathematics. The following relationships are reviewed quickly for the pupil:

a. The commutative principle for addition (ex. 1–2)
b. Facts with the addend 9 (ex. 3)
c. Near double facts in addition (ex. 4)
d. The identity element of addition (ex. 5)
e. Adding by endings (ex. 6–9)

Adding by endings is a fundamental skill which the pupils must thoroughly understand and master if they are to succeed in column addition. To add a column of figures like the one at the right, you begin at the bottom and add 6 and 7, which gives 13. You then add 13 and 5, which gives 18. In this addition, the combination $6 + 7$ is one of the 100 addition facts, but the combination $13 + 5$ is something new. Each of the 100 addition facts, like $6 + 7$, represents the adding of a 1-figure number to a 1-figure number. The new combination, $13 + 5$, however, represents the adding of a 2-figure number to a 1-figure number. In column addition this adding *must always be done mentally.* This skill of adding *mentally* a 2-figure number to a 1-figure number is called *adding by endings,* or *higher decade addition.* The term "adding by endings" arises from the fact that the *end figures* are of basic importance in finding the sum. For example, in the exercise at the right, the sum 18 depends on the fact that the sum of the end figures is 8.

$$\begin{array}{r}5\\7\\\underline{6}\end{array}$$

$$\begin{array}{r}5\\\underline{13}\\18\end{array}$$

In adding a longer column of figures, like the one shown at the right, the work involves the use, in rapid succession, of several combinations in adding by endings. For example, to add this column requires the use of the fundamental fact $6 + 7$ and of the following combinations in adding by endings: $13 + 5$, $18 + 6$, and $24 + 8$. It is apparent, therefore, that *successful work in column addition requires a mastery of adding by endings.*

$$\begin{array}{r}8\\6\\5\\7\\\underline{6}\end{array}$$

Ex. 6–16 on page 7 are exercises in adding by endings. All these examples are oral work, and the work must be done mentally. Have one pupil do ex. 6, have a second pupil do ex. 7, and so on through ex. 16. In each case the pupil is to give only the answer.

Key: 1. The order in which two addends are combined does not change the sum. **2.** $7 + 5 = 12$; $6 + 8 = 14$; $5 + 3 = 8$; $9 + 7 = 16$; $8 + 5 = 13$. **3.** $9 + 4 = 9 + (1 + 3) = (9 + 1) + 3 = 10 + 3 = 13$; $7 + 9 = (6 + 1) + 9 = 6 + (1 + 9) = 6 + 10 = 16$; $9 + 5 = 9 + (1 + 4) = (9 + 1) + 4 = 10 + 4 = 14$. **4.** $7 + 8 = 7 + (7 + 1) = (7 + 7) + 1 = 14 + 1 = 15$; $5 + 6 = 5 + (5 + 1) = (5 + 5) + 1 = 10 + 1 = 11$; $8 + 9 = 8 + (8 + 1) = (8 + 8) + 1 = 16 + 1 = 17$. **5.** 6; 4; 8; 0; n. The sum of zero and any other number is the other number. **8.** 68; 54; 22; 89; 37; 61; 98; 33. **9.** 96; 31; 39; 73; 82; 48; 62; 93. **10.** Adding 6: 69, 55, 23, 90, 38, 62, 99, 34; 97, 32, 40, 74, 83, 49, 63, 94; adding 8: 71, 57, 25, 92, 40, 64, 101, 36; 99, 34, 42, 76, 85, 51, 65, 96; adding 9: 72, 58, 26, 93, 41, 65, 102, 37; 100, 35, 43, 77, 86, 52, 66, 97.

Pages 8–9

Aim: To review column addition with 4 addends

Suggestions: Be sure to recheck the pupils' understanding of the vocabulary words *addends* and *sum.* Remind the pupils that they add up and check by adding down.

See page 56 for suggestions on using folded paper in taking this type of review test. This method will save pupils time in copying the examples and will allow the class to move more rapidly through Chapter 1 review work.

Page 9 is the first page which refers to the "More Practice" pages. See page 329 of the text for an explanation of how to use these pages.

Workbook Reference: Upton-Uhlinger: Arithmetic Workshop, Book 6, page 2 (published by American Book Company)

Key: Page 8 **2.** 24. **3.** 15 hr. **4.** 32; 30; 32; 41; 36; 33; 40; 44; 41. **5.** 297; 170; 220; 194; 192; 253. **6.** 272; 315; 390; 302; 247; 238. **7.** 248; 330; 331; 330; 438; 392.

Page 9 **2.** 2 tens; 3 hundreds. **4.** 3142; 2814; 3000; 2361; 2860; 3000. **5.** 2391; 2121; 2455; 3063; 3233; 1907. **6.** 3972; 5139; 4842; 7914; 9755.

Page 10

Aim: To review word problems with addition thought patterns

Suggestions: The word problems on this page involve everyday situations and should cause the pupil no difficulty. Ex. 6–9 present examples involving dollars and cents with addends ranged in horizontal order. If some pupils want to add horizontally, allow them to do so.

Key: **1.** $157.40. **2.** 1179 mi. **3.** $33.92. **4.** 183 children. **5.** 1374 doz. **6.** $43.32. **7.** $68.73. **8.** $77.26. **9.** $117.48.

Page 11

Aim: To test the pupils' mastery of the 100 subtraction facts

Suggestions: The 100 subtraction facts are supposed to have been mastered by the end of Grade 3. It will be found, however, that some sixth-grade pupils still have difficulty with some of these facts. In giving this test, follow the suggestions on page 327 of the text. See also the suggestions in this Guide for page 6 of the text.

Key: **1.** 1; 8; 5; 9; 2; 6; 3; 7; 3; 0. **2.** 2; 0; 4; 8; 0; 1; 7; 5; 3; 0. **3.** 0; 1; 9; 4; 8; 7; 6; 2; 5; 5. **4.** 5; 7; 4; 7; 3; 6; 4; 9; 2; 4. **5.** 8; 6; 5; 0; 4; 8; 7; 4; 4; 5. **6.** 3; 2; 9; 5; 6; 0; 8; 2; 6; 3. **7.** 8; 6; 9; 1; 6; 2; 8; 6; 9; 0. **8.** 9; 7; 1; 7; 9; 5; 4; 1; 1; 3. **9.** 3; 2; 5; 0; 6; 9; 2; 1; 1; 1. **10.** 7; 4; 2; 3; 7; 9; 0; 8; 3; 8.

Pages 12–13

Aims: To reteach a way of discovering basic subtraction facts and to review the steps in the process of subtraction

Suggestions: Ex. 1 on p. 12 reteaches the close association between subtraction and addition, that the one is the inverse of the other. Ex. 2 reviews the fact that 0 is the identity element of subtraction. Ex. 4 reteaches regrouping in subtraction and the basic vocabulary *minuend, subtrahend,* and *remainder* or *difference.* Beginning with ex. 6 and arranged in random order thereafter are all the steps in subtraction, from examples with no regrouping to examples with triple regrouping and with zeros in the minuend. Page 13 continues the practice work in subtraction by extending examples to 5-digit numbers with quadruple regrouping. Pupils who do not fully comprehend the work on these pages should be given a complete reteaching program before proceeding with this work.

Workbook Reference: Arithmetic Workshop, Book 6, page 3

Key: Page 12 **7.** 44; 26; 134; 635; 534; 466; 2725. **8.** 34; 117; 135; 183; 517; 433; 1209.

Page 13 **1.** 34 tickets. **2.** $6.31. **3.** 216 mi. **4.** 4513 pupils. **5.** 3587; 482; 3899; 15,689; 27,602. **6.** 968; 2535; 2753; 7648; 17,656. **7.** 450; 3429; 1848; 19,027; 8767. **8.** 6249; 1789; 1044; 12,353; 977. **9.** 3677; 346; 853; 53,986; 49,211. **10.** $94.89. **11.** 5386. **12.** 26,484.

Page 14

Aims: To review the 100 multiplication facts, relationships in multiplication, and the use of parentheses

Suggestions: The test on the 100 addition facts, given on page 6 of the text, can be used also as a test on the 100 multiplication facts. The only difference is that in one case the numbers are added while in the other case they are multiplied. This test should be an oral test and should be carried out in accordance with the suggestions on page 327 of the text.

If the test on the multiplication facts shows that certain pupils have not mastered all the facts, remedial exercises will be necessary. Pages 20 and 21 of the text give new and interesting ways of providing for remedial work on the multiplication facts. This unique work is based on number relationships. The following relationships are reviewed quickly for the pupil:

a. The commutative principle for multiplication (ex. 2–3)
b. Multiplication by zero (ex. 4)
c. The identity element of multiplication (ex. 5)
d. Near facts in multiplication

Review with the pupils that in any example containing parentheses the operation within the parentheses must be performed first.

Key: **2.** The order in which two factors are multiplied does not change the product. **3.** $8 \times 4 = 32; 7 \times 9 = 63; 7 \times 3 = 21; 5 \times 6 = 30; 8 \times 5 = 40$. **4.** 0; 0; 0; 0; 0. **5.** n; 7; 5; 9; 3. **7.** $5 \times 9 = (4 \times 9) + 9 = 36 + 9 = 45; 7 \times 8 = (6 \times 8) + 8 = 48 + 8 = 56$. **8.** $(6 \times 5) + 4 = 30 + 4 = 34; 2 + (4 \times 7) = 2 + 28 = 30; (9 \times 8) + 7 = 72 + 7 = 79; 3 + (5 \times 7) = 3 + 35 = 38$. **9.** $(9 \times 3) + 7 = 27 + 7 = 34; 2 + (5 \times 9) = 2 + 45 = 47; (6 \times 7) + 4 = 42 + 4 = 46; 6 + (9 \times 9) = 6 + 81 = 87$.

Page 15

Aim: To review multiplication taught in Grade 5, including the vocabulary of multiplication

Suggestion: Be sure to review the vocabulary words listed in ex. 2 and 3. Provide adequate practice similar to that suggested in ex. 4 and 5, since this type of mental activity is used continually in multiplication examples.

Key: **4.** 18; 48; 13; 38; 3; 33; 8; 43; 28; 23. **5.** 30; 78; 22; 62; 6; 54; 14; 70; 46; 38. **6.** 448; 874; 2304; 1026; 3332; 1416; 5494.

Pages 16–17

Aim: To reteach steps in multiplication

Suggestions: All steps in multiplication, including 3-figure multipliers, are reviewed on these pages. On page 16 point out that answers to problems should be labeled. In ex. 4, review with the pupils the commutative principle for multiplication. Page 17 is devoted primarily to zero difficulties in multiplication, and the short cuts illustrated in examples marked B are valuable to the good pupil. Pupils should, by this time, be able to understand and use these short cuts based on the concept of zero as a place holder. Stress the importance of checking work to insure accuracy.

Key: Page 16 **1.** 72 plants. **2.** (1) 960 doz.; (2) 11,520 eggs. **3.** $33.75. **4.** 984¢ or $9.84. **5.** 2782; 6552; 24,553; 28,936; 12,852; $264,69. **6.** 469,736; 131,744; 337,212; 270,725; 178,698; $1871.50. **7.** 759,050; 732,195; 249,216; 74,594; 123,360; $1794.52. **8.** 223,368; 250,113; 92,075; 178,703; 319,500; $1300.61. **9.** 27,889; 617,652; 284,484; 259,680; 476,424; $1153.44.
Page 17 **1.** 2190. **4.** 2450; 73,987; 326,172; 75,600; 184,258; 196,088. **5.** 6570; 4980; 49,572; 405,300; 27,810; 63,986.

Page 18

Aim: To provide practice in solving problems

Suggestion: Be sure that pupils first determine which arithmetical process must be used to solve each problem.

Workbook Reference: Arithmetic Workshop, Book 6, page 5

Key: **1.** $699.70. **2.** $13.15. **3.** 2352 words. **4.** 1061 mi. **5.** $27.00. **6.** $3.53. **7.** 1261 pupils.

Page 19

Aim: To review Roman numerals

Suggestion: The main purpose in the teaching of Roman numerals is to enable pupils to read them. Emphasize the two rules in ex. 3 on page 19, which tell how to read Roman numerals.

Key: **4.** 64; 26; 94; 1601; 1350. **5.** 46; 69; 44; 1905; 1960. **6.** 205; 1900; 951; 1300; 2019. **7.** 112; 1200; 411; 460; 79. **8.** XXXIX; XLVII; CCCXXV; MDCCCXCII; MCMLVIII; MDCCX. **9.** LVI; XCIV; DLXXI; MLXVI; MDXLIX; MDCCCLXXVII. **10.** LXXXIII; LXVIII; CCXIV; MCDL; MDCXX; MCMLXII.

Page 20

Aim: To teach the pupils an easy way to remember the multiplication facts for the 4's, 6's and 8's

Suggestions: Most pupils have little difficulty with the multiplication facts for the 2's and the 3's, but trouble sometimes develops with the 4's. Ex. 1 and 2 on page 20 show how the pupil's knowledge of the 2's facts will help him to get the answer to any one of the 4's facts if he has forgotten it. Similarly, ex. 3 and 4 on this page show the pupil how to use his knowledge of the 3's facts to get the answer to any one of the 6's facts. Ex. 5 shows the pupil how to use his knowledge of the 4's facts to get any one of the 8's facts. The work on this page, by which the pupil obtains the answer to a hard fact from any easy fact, is all *mental work*. This mental work is easily done, however, after very little practice. The sole purpose of all this work is to present methods by which the pupil can find the answer to a forgotten fact by *thinking* instead of by looking it up in a chart or asking the teacher to tell it to him. After the pupil finds the correct answer a few times in this way, he soon comes to remember it so that he can say it instantly without help of any kind. The work on this page is an important application of number relationships.

Key: 2. (1) $2 \times 7 = 14$, $2 \times 14 = 28$. So $4 \times 7 = 28$. (2) $2 \times 5 = 10$, $2 \times 10 = 20$. So $5 \times 4 = 20$. (3) $2 \times 9 = 18$, $2 \times 18 = 36$. So $9 \times 4 = 36$. **4.** (1) $3 \times 5 = 15$, $2 \times 15 = 30$. So $6 \times 5 = 30$. (2) $3 \times 9 = 27$, $2 \times 27 = 54$. So $6 \times 9 = 54$. (3) $3 \times 7 = 21$, $2 \times 21 = 42$. So $7 \times 6 = 42$. (4) $3 \times 3 = 9$, $2 \times 9 = 18$. So $3 \times 6 = 18$. **7.** 40; 32; 48; 24; 72. **8.** 56; 36; 40; 64; 72.

Page 21

Aim: To teach the pupils how to remember the 9's facts in multiplication

Suggestions: This page will merit most careful study since it describes a very interesting way by which the pupil can get the answer to a 9's fact in multiplication if he has forgotten it. This plan depends upon certain interesting number relationships that are connected with the 9's facts. These relationships are:

(1) In the 9's facts the first figure of the answer is always 1 *less* than the number by which 9 is multiplied. For example, in $7 \times 9 = 63$, the first figure of 63, which is 6, is 1 less than 7. Likewise, in $6 \times 9 = 54$, the first figure of 54, which is 5, is 1 less than 6.

(2) In the 9's facts the sum of the two figures in each answer is always 9. For example, the answer to 5×9 is 45; if you add 4 and 5, the sum is 9. Likewise, the answer to 8×9 is 72; if you add 7 and 2, the sum is 9.

(3) If you know the first figure of the answer to a 9's fact, you can get the second figure by adding enough to the first figure to make 9. For example, if the first figure of the answer is 3, the second figure must be 6 because 3 and 6 make 9. If the first figure is 7, the second must be 2 because 7 and 2 make 9.

Ex. 1 and 2 on page 21 explain to the pupil the first of the relationships given above, while ex. 3 explains the second and third of these relationships. Ex. 4 and 5 show the pupil how to use the three relationships to find the answer to any of the 9's facts. After a little practice, the pupil can quickly get the answer to any of the 9's facts by this method.

It should be understood that the purpose of this work is to show the pupil how to get the answer to a 9's fact if he has forgotten it and to do this by *thinking* instead of asking the teacher the answer or looking it up in a table. By getting the correct answer several times through one of the three relationships, he will soon memorize it. If the pupil already knows the 9's facts, the work on page 21 is, of course, unnecessary. The 9's facts have always been regarded as among the most difficult of the multiplication facts; hence, it is probable that a number of pupils still have trouble with some of these facts and will profit by this work.

Page 22

Aim: To test the pupils' mastery of the 90 division facts

Suggestions: All 90 even division facts are given on this page. Of these 90 facts, 9 are zero facts. A zero fact is one like $3\overline{)0}$, which has 0 as the dividend. Detailed suggestions for testing each pupil's mastery of these facts are given on page 327 of the text. Flash cards may be used for this test. If the pupil does poorly on the test, first make sure that he knows the multiplication facts because a mastery of the division facts depends upon a mastery of the multiplication facts, as explained at the top of page 23 of the text.

Key: 1. 2; 0; 1; 6; 2; 8. **2.** 2; 2; 0; 7; 5; 7. **3.** 0; 9; 8; 4; 6; 5. **4.** 4; 1; 9; 6; 6; 3. **5.** 3; 8; 4; 7; 3; 5. **6.** 3; 3; 7; 4; 8; 8. **7.** 0; 1; 2; 6; 9; 4. **8.** 1; 0; 9; 6; 5; 4. **9.** 5; 0; 5; 8; 5; 3. **10.** 0; 1; 6; 9; 4; 4. **11.** 2; 0; 6; 8; 2; 7. **12.** 1; 6; 5; 7; 3; 9. **13.** 7; 0; 7; 9; 7; 2. **14.** 1; 1; 8; 3; 3; 8. **15.** 4; 1; 9; 2; 5; 9.

Page 23

Aims: To reteach relationships among division facts; to review some uneven division facts

Suggestions: Ex. 1 and 2 demonstrate that division is the inverse operation of multiplication. Ex. 4 illustrates that 1 is the identity element of division. The identity element of an arithmetic process is that number which, when operative with another number, will not change the value of the other number. Review with the pupils that 0 is the identity element of addition and of subtraction, and that 1 is the identity element of multiplication, as well as of division.

Division facts like $3\overline{)6}$ and $4\overline{)12}$ are called *even division facts* since the division is exact without a remainder. Facts like $3\overline{)7}$ and $4\overline{)14}$ are called *uneven division facts* because the division is not exact and leaves a remainder. In both the even and the uneven division facts, the quotient is always a number of 1 figure. An example like $2\overline{)23}$ is *not* an uneven division fact because the quotient is a 2-figure number.

To find the remainder for an uneven division fact like $3\overline{)26}$, the pupil must subtract 24 from 26 mentally. An easy way to do this is to think "24 and what make 26"? The remainder is 2 because 24 and 2 make 26.

Key: 2. 7; 9; 9; 8. **3.** 0; 0; 0; 0. **4.** 4; 6; 8; 3. **5.** 1; 1; 1; 1. **6.** Yes; no. **7.** 3 and 1 over; 7 and 1 over; 5 and 1 over; 5 and 1 over; 4 and 2 over; 6 and 1 over; 4 and 1 over. **8.** 1 and 2 over; 6 and 1 over; 4 and 3 over; 8 and 1 over; 6 and 1 over; 7 and 4 over; 4 and 3 over.

Pages 24–25

Aim: To review the short form of division

Suggestions: The *short form of division* refers to division with 1-figure divisors. Such division is sometimes done by writing down all the steps as shown in A on page 25; this is called the *long form* of division. The long form is usually used when the divisor is 6, 7, 8, or 9. The division may be done also in the *short form*, as shown in B on page 25. In the short form all the steps are done *mentally*, only the answer being written. The short form is recommended when the divisors are small numbers like 2, 3, 4, and 5. The short form may be used also when the divisors are 6, 7, 8, and 9; but the mental work is much more difficult with these larger divisors. If you have two exercises like $4\overline{)338}$ and $9\overline{)338}$, and work each of them mentally, you can see quickly that the mental work is much easier when the divisor is 4 than when it is 9.

If some of the pupils in your class are *below average* in ability, they may find it too difficult to do any of the work in short division mentally, even with small divisors like 2 and 3. In such cases, all the work should be done in the long form, each of the steps being written. This suggestion applies also to all the pupils in your class if they make frequent mistakes when they attempt to do mental short division. The important thing is for the pupils to get correct answers; hence, the method selected should be the one that will produce such results.

Workbook Reference: Arithmetic Workshop, Book 6, page 6

Key: Page 24 **2.** 53 R3; 87 R1; 1797; 939; 2739. **3.** 47 R5; 26 R4; 896; 1378; 2784. **4.** 137 R3; 463 R1; 386 R3; 1027 R2; 2963 R1. **5.** 265; 219 R2; 1238 R5; 1429; 6253. **6.** 70 R7; 58 R3; 3855; 654; 5076.

Page 25 **2.** 27; 32; 32 R3; 53 R3; 84; 238. **3.** 43 R1; 12 R1; 41; 72 R2; 408 R1; 134 R4. **4.** 23 R1; 21 R1; 160 R4; 83 R1; 211 R3; 79. **5.** 2159; 309 R4; 697; 1687; 2786. **6.** 569; 4379; 2187 R2; 978 R1; 8054. **7.** 648 R1; 514; 738 R1; 1309; 5439.

Page 26

Aim: To review the use of a fraction in the quotient

Suggestions: In a division example, there are three acceptable methods of expressing a remainder in the quotient. They are:

a. By writing an R followed by the remainder
b. By using a plus sign
c. By writing the remainder as a fraction

The first method was proposed when the pupils began their work in division and is a perfectly acceptable plan. Mathematicians tend to use the plus sign after they have carried the answer to as many decimal places as they wish. After the pupils have been taught to carry answers to decimal places, the plus sign will be the most commonly used method of expressing remainders. The third method of writing the remainder, as a fraction, is good under certain conditions. However, the indiscriminate use of the fraction as a remainder or the blind insistence that every such fraction be changed to lowest terms becomes a fetish which is not justified in mathematics. The examples on this page call for the use of the fraction, but pupils should be alerted to the fact that this is only ***one way of expressing a remainder.***

Workbook Reference: Arithmetic Workshop, Book 6, page 7

Key: **3.** $3\frac{1}{2}$ yd. **4.** 11 pupils and 1 over. **5.** $6\frac{1}{4}$ ft. **6.** $19\frac{1}{2}$; $92\frac{3}{4}$; $672\frac{1}{6}$; $563\frac{7}{8}$; $742\frac{2}{5}$. **7.** $18\frac{3}{4}$; $446\frac{1}{2}$; $194\frac{3}{7}$; 356; $419\frac{5}{6}$. **8.** $13\frac{4}{7}$; $52\frac{2}{9}$; $498\frac{4}{5}$; $847\frac{1}{2}$; 386. **9.** $14\frac{5}{6}$; $186\frac{2}{5}$; 706; $867\frac{1}{7}$; $937\frac{2}{3}$. **10.** $27\frac{2}{3}$; $91\frac{5}{7}$; $427\frac{5}{8}$; 385; $534\frac{3}{4}$.

Page 27

Aim: To reteach pupils how to round off numbers

Suggestions: Before beginning the work on this page, pupils should be reminded that we round off numbers many times in everyday life. Mother or Father will read in the paper that a suit costs \$39.50 and will say that the suit costs around \$40.00. Similarly, the price of a bicycle might be quoted at \$48.50, and Father will remark that it is a fifty-dollar bicycle.

Pupils will recall that in doing division in Grade 5, the divisor was rounded off to the next higher ten when a 2-figure divisor ended in 6 or more (28 was rounded off to 30), and the divisor was rounded off to the next lower ten when the divisor ended in 1 to 5 (22 was rounded off to 20).

The work on this page deals with rather large numbers and calls for rounding off to the nearest billion, million, thousand, hundred, and ten.

This concept of rounding off is basic to estimation, and pupils should become alert to the fact that numbers can be rounded off in any way that the calculator wishes. Naturally, the more sweeping the rounding off, the less accurate the figure. This concept will be referred to later as the matter of *significant figures.* In the number 573,891 there are 6 significant figures. When rounded off to 600,000 there is 1 significant figure. The greater the number of significant figures, the greater the accuracy of the number.

Key: **4.** 9,000,000; 9,000,000; 47,000,000; 15,000,000. **5.** 4000; 9000; 7000; 9000; 7000; 5000. **6.** 700; 500; 200; 800; 900; 400. **7.** 20; 70; 90; 70; 80; 50; 40; 50.

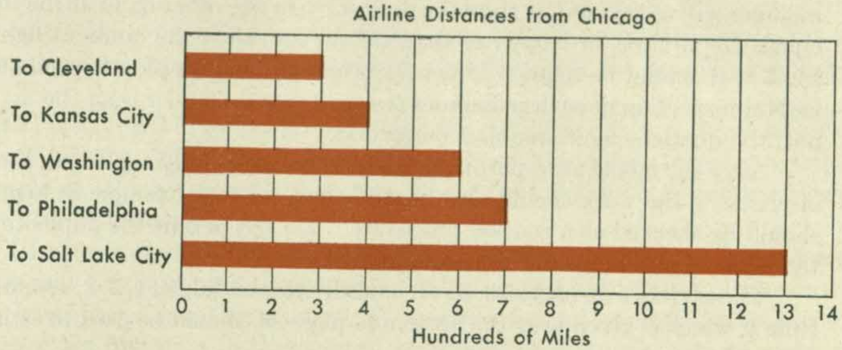
Page 28

Aim: To reteach the reading and construction of bar graphs

Suggestions: Numbers which have been rounded off are used in constructing the graph at the top of the page. Pupils are required to round off the numbers in ex. 6 before making the graph. Data similar to these are found in any social-studies book. Pupils should be encouraged to seek out such data during social-studies classes and thus increase their ability to read and make graphs. Although the bar graph is under consideration here, modern teachers will remind pupils that there are other ways of drawing (or graphing) the same data; *i.e.*, line and picture graphs.

Key: **1.** 600 mi. **2.** 200 mi. **3.** (1) 700 mi.; (2) 1100 mi.; (3) 900 mi.; (4) 400 mi.

6.



Pages 29–31

Aim: To review division with 2-figure divisors ending in 1, 2, 3, 4, or 5

The Teaching of Long Division. Long division is the most difficult operation with whole numbers, not only for children but also for adults. The hardest part of long division is in estimating the correct quotient figures. In this book, long division is taught by a method that gives the correct quotient figure *on first trial* in 80% of all cases. In the remaining 20% of cases, the correct quotient figure is found, with very minor exceptions, after a single correction of the trial quotient figure. The procedure so often used, by which the pupil tries first one quotient figure and then another until he finds the correct one, is thus avoided.

In order to obtain such high efficiency in finding quotient figures, this book uses two rules for estimating quotient figures. One of these rules applies to 2-figure divisors ending in 1 to 5 and is stated in the middle of page 29 of the text; the other rule applies to 2-figure divisors ending in 6 to 9 and is stated on page 32. In this Guide these rules, for convenience, will be called Rule I (divisors ending in 1 to 5) and Rule II (divisors ending in 6 to 9).

The treatment of long division as given in this series of arithmetics is one of the outstanding features. For a more detailed discussion of this highly efficient method of long division, see pages 4–5 of this Guide.

Suggestions: The work in long division as presented on pages 29–35 of this text is a review of the work in long division that was given in the fifth grade. When the work on page 29 is first presented to the class, put the model example 1 on the blackboard and go through each step of finding each quotient figure. In this work remind the pupils that there are five steps in finding each quotient figure:

(1) *Divide* the partial dividend by the divisor.
(2) *Multiply* the divisor by the quotient figure.
(3) *Subtract.*
(4) *Compare* the remainder with the divisor. The remainder should always be less than the divisor.
(5) *Bring down* the next figure of the dividend.

Of these five steps, emphasize the importance of Step 4, in which the remainder is compared with the divisor. If the quotient figure is correct, the remainder *will always be less* than the divisor. On the other hand, if the remainder equals the divisor, or is greater than the divisor, then the quotient figure is too small and should be made 1 larger. Success in long division depends upon the careful inspection of each remainder to see that it is smaller than the divisor. If not, the quotient figure requires correction.

After the model example on page 29 has been carefully explained, the method of checking the work should also be explained. Every example in long division should be checked as a routine procedure. Do not permit the pupils to get into the habit of checking only occasionally.

The exercises on pages 29–31 all have divisors ending in 1, 2, 3, 4, or 5. Hence Rule I, which is given near the bottom of page 29, should be used to estimate the quotient figures.

Workbook Reference: Arithmetic Workshop, Book 6, page 8

Key: Page 29 **2.** 38; 36 R15; 329 R10; 724 R30. **3.** 46; 26 R33; 374; 627 R5. **4.** 57 R4; 82 R28; 482 R23; 427 R29. **5.** 62 R6; 57 R18; 725 R7; 573.

Page 30 **3.** 58 R24; 67 R70; 67 R59; 537 R41. **4.** 69 R17; 62 R60; 39 R31; 792 R77. **5.** 74 R38; 79 R16; 37 R50; 295 R58. **6.** 57 R19; 78 R15; 57 R18; 827 R12.

Page 31 **1.** 57 mi. **2.** 800 ÷ 54 = 14 R44, or 15 (coaches). **3.** 185 mi. **4.** 343 mi. **5.** 163; 216; 328 R7; 563 R23. **6.** 263; 65 R27; 973; 282. **7.** 92; 98; 621; 1326. **8.** 366; 215; 289 R17; 718. **9.** 421 R12; 128; 833; 463 R11. **10.** 96; 95 R51; 716 R17; 367. **11.** 322 R16; 47; 373; 419 R32.

Pages 32–34

Aims: To review division with 2-figure divisors in which the divisor ends in 6, 7, 8, or 9, and to extend the quotient to 4 figures

Suggestions: The work on page 32 introduces 2-figure divisors ending in 6, 7, 8, and 9. In exercises with such divisors, each quotient figure is estimated by dividing by 1 *more than the first figure* of the divisor. For example, if the divisor is 49, you divide by 5 to estimate each quotient figure. If the divisor is 68, you divide by 7 to estimate each quotient figure.

The model example should be put on the board as you explain the work on page 32. In this example the divisor is 29, which is almost 30. You divide by 3 to estimate the quotient figure.

In this Guide the rule given on page 32 is, for convenience, called Rule II. Sometimes Rule II gives a quotient figure that is too small; hence, the figure must be corrected to the next larger figure. When the quotient figure needs correction, the remainder will be equal to, or larger than, the divisor. Hence, by watching the remainder, you will always know whether the quotient figure needs correction. When you have the right quotient figure, the remainder will be less than the divisor.

In this connection it should be emphasized that Rule II gives the correct quotient figure *on first trial* in 80% of all cases. In the other 20% of cases only one correction is necessary, except in one case out of every 2250 cases, when two corrections are necessary. It is evident, therefore, that the possibility of having to correct the quotient figure twice with Rule II is practically negligible. If Rule II is not used in connection with divisors ending in 6 to 9, several corrections of each quotient figure are often necessary; see page 4 of this Guide for a division example in which repeated correction of quotient figures is necessary because Rule II is not followed.

In schools in which this series of textbooks is being used for the first time, the pupils may not have been taught to use Rule II in the fifth grade. Instead, they may have been taught to estimate all quotient figures by dividing by the first figure of the divisor. In that event, the pupils found it necessary to make frequent corrections of quotient figures in connection with divisors ending in 6 to 9. Such frequent corrections could have been avoided, however, had Rule II been used. The question then arises: "What shall I do in the sixth grade if the pupils did not use Rule II in the fifth grade?" The answer emphatically is to teach the pupils to use Rule II in the sixth grade and thus avoid frequent corrections of quotient figures when the divisors 6 to 9 are used.

Workbook Reference: Arithmetic Workshop, Book 6, page 9

Key: Page 32 **2.** 4; 7; 6; 5; 4; 10. **3.** 46 R25; 26 R23; 439 R18; 294 R37. **4.** 54 R15; 51 R74; 429 R30; 347 R55. **5.** 86 R26; 47 R15; 594 R7; 492 R25. **6.** 78 R25; 38 R28; 846 R55; 927 R17.

Page 33 **2.**

$$\begin{array}{r} 92\\ 27\overline{)2501}\\ \underline{243}\\ 71\\ \underline{54}\\ 17 \end{array} \qquad \begin{array}{r} 72\\ 48\overline{)3485}\\ \underline{336}\\ 125\\ \underline{96}\\ 29 \end{array} \qquad \begin{array}{r} 849\\ 36\overline{)30564}\\ \underline{288}\\ 176\\ \underline{144}\\ 324\\ \underline{324} \end{array} \qquad \begin{array}{r} 916\\ 26\overline{)23816}\\ \underline{234}\\ 41\\ \underline{26}\\ 156\\ \underline{156} \end{array}$$

3. 84; 63; 93; 824. **4.** 29 R3; 71; 73 R17; 947 R9.

Page 34 **1.** 386 mi. **2.** $34.85. **3.** $198. **4.** 43 passengers. **5.** 281; 127; 1773; 1871. **6.** 523 R5; 114; 786; 1234. **7.** 182 R21; 143; 1834 R14; 351 R27. **8.** 217; 467; 785 R42; 1123. **9.** 38 R55; 98; 1283; 1142. **10.** 312 R3; 162; 662 R18; 715 R11.

Page 35

Aim: To review zero difficulties in the quotient

Suggestions: The three model examples need careful study since they represent certain zero difficulties that occur frequently in division. In this connection, remind the pupils that every time they bring down a figure from the dividend, they must put a new figure in the quotient. This step is illustrated in the second model example: when 1 is brought down, the new partial dividend becomes 31;

therefore a new figure must be put in the quotient. Since 31 does not contain the divisor 73, the new quotient figure in this case is 0. The third model example also requires careful study since in this case two 0's must be written in the quotient.

Workbook Reference: Arithmetic Workshop, Book 6, page 12

Key: **2.** 2004; 920 R6; 8010 R8. **3.** 208; 1050; 8340 R12. **4.** 209 R26; 490 R31; 6009. **5.** 540; 3008; 4070 R10. **6.** 3006; 2030 R10; 3040 R15. **7.** 750; 206 R4; 8016. **8.** 390 R5, or about 390 (mi.). **9.** \$20.09. **10.** 105 lb.

Page 36

Aim: To provide an oral and a written review of basic division examples

Key: **1.** 5, 12, 8, 7 R1, 8 R1, 11 R1, 4 R3, 2; 4, 9 R3, 6 R2, 5 R4, 6 R3, 9, 3 R4, 1 R3. **2.** 3 R1, 6 R1, 10 R1, 4 R1, 9 R1, 7, 7 R3, 0 R3; 2 R3, 5, 8 R1, 3 R2, 7 R2, 5 R3, 6 R1, 0 R3. **3.** 21; 42; 240; 51; 81; 91. **4.** 231; 70; 31; 60; 302; 341. **5.** 43; 98; 58; 85; 67; 75. **6.** 4; 3; 21; 42. **7.** 6; 9; 46; 41. **8.** 9; 9; 12; 40. **9.** 1; 48; 29; 203. **10.** 806; 738; $4560\frac{9}{26}$. **11.** $380\frac{7}{85}$; 1263; 2979. **12.** $846\frac{7}{18}$; 909; $8045\frac{11}{63}$. **13.** $1398\frac{5}{54}$; 750; 6607. **14.** 187; $521\frac{12}{23}$; $4200\frac{37}{89}$. **15.** 2030; $645\frac{21}{58}$; 6129. **16.** 241; $853\frac{7}{19}$; 697; $5798\frac{13}{19}$. **17.** $45\frac{3}{25}$; $620\frac{11}{25}$; 938; 4191. **18.** $27\frac{8}{57}$; $205\frac{40}{57}$; 1475; 6009.

Page 37

Aim: To review measures taught in preceding grades

Key: **1.** 2 wk. 4 da. = 18 da., 4 wk. = 28 da., 28 da. − 18 da. = 10 da. **2.** 1 lb. 2 oz. = 18 oz., 18 oz. − 10 oz. = 8 oz. The box marked "1 lb. 2 oz." held 8 oz. more. **3.** 145 ÷ 12 = 12 R1, or 12 doz. with 1 cookie over. **4.** (1) $\frac{1}{2} \times 40¢ = 20¢$; (2) $\frac{3}{4} \times 40¢ = 30¢$. **5.** 3 × 32 = 96 (ft.); John needs 1 roll. **6.** (1) 320 half pints = 160 pints = 80 qt.; (2) 80 qt. = 20 gal.; (3) 320 × 15¢ = 4800¢ or \$48.00; (4) \$48.00 ÷ 20 = \$2.40. **7.** 2; 9; $\frac{3}{4}$. **8.** $\frac{1}{2}$; 180; 48. **9.** 2; 45; $\frac{3}{4}$. **10.** 18; $\frac{1}{2}$; 6. **11.** 32; 3; 30. **12.** 8; 2; 1000. **13.** 18; 30; 6. **14.** $\frac{1}{4}$; 36; 2. **15.** 5280; 27; 4.

Page 38

Aim: To review problems dealing primarily with money

Key: **1.** \$14.72 ÷ 4 = \$3.68. **2.** \$2.50 + \$1.25 + \$.85 + \$.25 = \$4.85. **3.** 225 ÷ 7 = $32\frac{1}{7}$, or about 32 (mi.). **4.** 600 ÷ 24 = 25 (cases). **5.** \$2.75 + \$.75 = \$3.50. **6.** \$27.50 − \$19.79 = \$7.71. **7.** 15 × 24 = 360 (cans). **8.** \$5.00 − \$3.17 = \$1.83.

Page 39

Aim: To present problems without questions

Suggestions: Problem work of the type given on page 39 allows pupils to become a part of the problem situation. You can make a valuable evaluation of the thinking ability of a pupil if you study the question suggested for each problem on this page. When pupils make their suggestions, there may be more than one problem for each set of data presented. Encourage pupils to solve all the problems constructed by the class. Also, the group should critically evaluate the questions, thus allowing each pupil to think discriminately about the problem situation. Questions such as the following might serve as a basis for discussion:

1. Does the question make sense?
2. Would the question ever be asked?

Workbook Reference: Arithmetic Workshop, Book 6, page 30

Page 40

Aim: To review the major aims of Chapter 1

Suggestion: The test items on this page review directly 8 of the 14 aims listed in this Guide at the beginning of this chapter. These are:

Chapter Review	*Aim Number*
Ex. 1, 3, 4	13
Ex. 2 and 8	4
Ex. 5	3
Ex. 6 and 9	2
Ex. 7	1
Ex. 10 and 11	9
Ex. 12	10
Ex. 13–16	11

Also, Aim 4 is tested in detail on page 42, and Aim 14 is tested thoroughly on page 41.

Key: **1.** (1) Yes; (2) 6288 ft. − 5280 ft. = 1008 ft. (more). **2.** \$128.65 ÷ 31 = \$4.15. **3.** 9:20 A.M. to 11:05 A.M. = 1 hr. 45 min. **4.** From 4:45 P.M. to 6:03 P.M. is 78 min. **5.** 818,322. **6.** \$400.00 − \$263.78 = \$136.22. **7.** 10,991. **8.** 13,091 ÷ 49 = 267 R8. The remainder is 8. **9.** 36,564. **10.** 76; 1701; 44; 1900; 610; 97; 2000; 209. **11.** XLVIII; LXV; LXXXIII; XCVI; CCIV; MCDXCII; MDC; MDCCXXV; MCMLIX; MMXXXV. **12.** 26,246; 800,000; 30,000,080; 2,007,552,000. **13.** 900; 500; 1000; 600; 400; 100. **14.** 2000; 4000; 5000; 4000; 9000. **15.** 5100. **16.** 40,000; 90,000; 20,000; 50,000; 10,000.

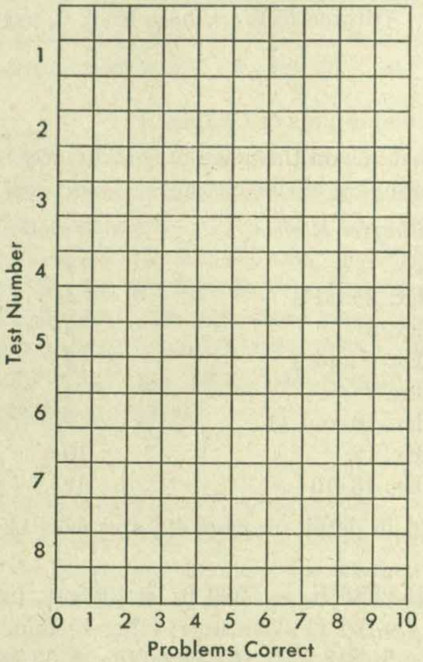
Page 41

Aim: To present Problem Test 1

Suggestions: Many pupils will enjoy keeping a yearly record of their problem-test scores as rated by the chart at the top of page 24. Such a record can be kept by means of a bar graph on which the color of the bar indicates the rating. For instance, a rating of "You need help" could be colored red, a "Fair" rating could be brown, a "Good" rating could be green, and an "Excellent" rating could be blue. The chart should be planned for eight problem tests and might appear as shown on the next page.

GRADE SIX PROBLEM-TEST RECORD

If your rating is "You need help," color the column *red.*
If your rating is "Fair," color the column *brown.*
If your rating is "Good," color the column *green.*
If your rating is "Excellent," color the column *blue.*



On how many tests were you a blue-ribbon winner?

Workbook Reference: Arithmetic Workshop, Book 6, page 15

Key: **1.** \$52.00 + \$7.50 + \$11.75 + \$8.80 + \$.95 + \$.20 = \$81.20 or 8120¢, 8120¢ ÷ 35¢ = 232 (tickets). **2.** 17 × \$.26 = \$4.42. **3.** \$10.00 − \$3.95 = \$6.05. **4.** \$11.00 ÷ 4 = \$2.75. **5.** 438 × \$1.95 = \$854.10. **6.** 665 ÷ 39 = $17\frac{2}{39}$, or about 17 (hr.). **7.** \$1.79 + \$15.50 + \$.50 + \$.57 + \$1.69 + \$5.95 = \$26.00. **8.** 648 ÷ 36 = 18 (yd.). **9.** \$95.00 − \$67.35 = \$27.65. **10.** 6 × \$49.50 = \$297.00.

Page 42

Aim: To provide a diagnostic test with page references for remedial work

Suggestions: Page 42 is a diagnostic test covering the computational skills reviewed in Chapter 1. Observe how this diagnostic test is constructed: the four fundamental operations with whole numbers are tested by sets of examples. If a pupil gets the right answer on all but one of the examples in ex. 1–2, the wrong answer was probably caused by an accidental error. But if he misses two or three examples in these lines, something fundamental is probably wrong. In such a case, endeavor to discover the reason for the errors. In some instances the error may be due to an incomplete mastery of the addition facts; if this is true, give the pupil a list of the facts that are causing him trouble and point out the number relationships involved. In other cases, the pupil may not understand a step involved in the process, such as carrying, in which case reteaching is necessary. After correcting the fundamental difficulties, assign additional practice on the page listed at the end of the row.

Workbook Reference: Arithmetic Workshop, Book 6, page 14

Key: **1.** 2174; 3989; 2385; 2785; 2186. **2.** 12,343; 15,000; 17,067; 18,205; 7700. **3.** 1537; 630; 31,578; 26,559. **4.** 1998; 2837; 27,492; 20,247. **5.** 61,901; 459,836; 172,961; 117,724; 399,811. **6.** 377,696; 765,630; 78,228; 533,120; 126,730. **7.** 45 R13; 67 R6; 738. **8.** 148 R22; 217 R6; 923. **9.** 209 R7; 4006; 6080 R11.

Chapter 2

Aims of Chapter 2. The major aims of Chapter 2 are to:

1. Review the fundamental skills pertaining to whole numbers.
2. Review the meaning and simplification of common fractions.
3. Reteach the addition and subtraction of fractions with related denominators.
4. Reteach the finding of the least common denominator and the solution of examples in addition and subtraction of common fractions needing a least common denominator.
5. Develop the idea of improvement tests and show pupils how to use line graphs to record individual scores.
6. Reteach the keeping of personal accounts and explain the use of a cash book.
7. Review two-step word problems and introduce three-step problems.

Pages 43–44

Aim: To review problem solving by means of a project on the Golden Gate Bridge

Suggestions: The numerical facts concerning the Golden Gate Bridge at San Francisco are authoritative, having been furnished by the administrative board in charge of that bridge. The Golden Gate bridge is one of the world's great bridges. In ex. 1 on page 44 the pupil is asked whether the Golden Gate Bridge is a little more, or a little less, than $1\frac{1}{4}$ mi. long. The easiest way to answer this question is to change $1\frac{1}{4}$ mi. to 6600 ft. and then to compare 6600 ft. with 6450 ft. (4200 ft. + 1125 ft. + 1125 ft.), which is the total length of the bridge.

Key: Page 43 **3.** 5280 ft. − 4200 ft. = 1080 ft. **4.** 746 ft. ÷ 12 ft. = 62 R2, or 62 stories.

Page 44 **1.** (1) 4200 + 1125 + 1125 = 6450 (ft.); (2) $1\frac{1}{4}$ mi. = 6600 ft.; less. **2.** (1) 220 ft. − 204 ft. = 16 ft.; (2) 236 ft. − 204 ft. = 32 ft. **4.** 21,000,000 ÷ 12 = 1,750,000 (cars and trucks). **5.** 50¢ = \$.50; 1,750,000 × \$.50 = \$875,000.00. **6.** Yes; $\frac{1}{2}$ × 4200 ft. = 2100 ft.; 2100 ft. − 1595 ft. = 505 ft. (less).

Pages 45–47

Aim: To teach pupils how to keep cash accounts

Suggestions: The method of keeping a cash account which is described on page 45 should have very careful study. This method is the one used by bookkeepers and other persons who keep cash accounts and is more technical than the informal account which a child might keep if he had no instruction in such matters. Point out to the pupils that the account shown in ex. 1 *balances* when each side of the account has a total of \$6.70. It is this *balancing* that shows that the account is correct. If the total had been \$6.70 on one side of the account and \$6.40 on the other side, something would be wrong and, consequently, need correction. The purpose of the work on pages 45–47 is to acquaint the pupils with the accepted method of keeping simple cash accounts.

Page 46 presents a different accounting experience, but the plan for keeping the account is the same. Page 47 asks the pupils to make their own cash books for one week. If some children enjoy this type of out-of-school activity, you might suggest that they continue with it on a voluntary basis for one month, and possibly even until January 1. During the fall months, pupils are earning money in anticipation of Christmas spending.

Key: Page 45 **4.** If Mary forgot to write down the $.10 for paper bags, the following would happen when she balanced the account as shown in ex. 1: On the left side, the sum would be $1.40 + $.50 + $4.80, or $6.70. On the right side, the sum would be $.49 + $.51 + $.23 + $.34, or $1.57. Subtracting $1.57 from $6.70, she would get $5.13, which is the amount she *ought to have* on hand. But when she counted her cash, she would find only $5.03 instead of $5.13, so she would be $.10 short. Suppose she now remembers that she spent $.10 for paper bags a few days ago. If she corrects her account by entering this $.10 on the right side and adds that side again, she will then find that she ought to have $5.03 on hand, which agrees with the amount she actually has on hand. When you balance an account, if your actual cash on hand is *less* than you ought to have, you may have forgotten to write down some money that you have spent.

What would happen if she forgot to enter some dues she had received? Suppose she received $.20 in dues that she forgot to enter in the account shown in ex. 1. Then her account would look exactly like the one in ex. 1. When she balanced the account, she would find that she *ought to have* $5.03 on hand; but when she counted her money, she would find $5.23 in actual cash, which is $.20 *more* than she ought to have. If she now corrects the account by entering the $.20 in dues that she had omitted, the left side will then have a sum of $6.90. If she adds the right side, she will get $.49 + $.51 + $.23 + $.34 + $.10, or $1.67. Subtracting $1.67 from $6.90, she will get $5.23, which is the amount of cash she *ought to have.* She finds that she actually has $5.23, so her account balances. When you balance an account, if you have *more cash* than you ought to have, you may have forgotten to write down some amount that you received.

Page 46 **2.** Sum of left side is $3.85; sum of right side is $3.09; $3.85 − $3.09 = $.76. **3.** (1) $.76 − $.61 = $.15; (2) yes.

4.

Money Received				Money Paid Out			
Oct. 9	Cash on hand		61	Oct. 10	Bus fare		30
Oct. 10	Running errand		25	Oct. 10	Lunch		25
Oct. 12	Helping at store		85	Oct. 12	Birthday gift		75
Oct. 14	Allowance		75	Oct. 13	Notebook		25
Oct. 15	Raking leaves		35	Oct. 14	Stamps		12
				Oct. 16	Cash on hand	1	14
	Total	2	81			2	81
Oct. 16	Cash on hand	1	14				

Page 47 **3.**

Money Received				Money Paid Out			
Oct. 9	Cash on hand		85	Oct. 11	Movies		30
Oct. 10	Baby-sitting	1	50	Oct. 13	Lunch		35
Oct. 11	Delivering cookies		25	Oct. 13	Present for Mother		95
Oct. 15	Allowance	1	00	Oct. 14	Put in bank	1	75
Oct. 15	Sale of used book		45	Oct. 15	Pencil		05
				Oct. 15	Lunch		35
				Oct. 16	Cash on hand		30
	Total	4	05			4	05
Oct. 16	Cash on hand		30				

4.

Money Received				Money Paid Out			
Nov. 1	Cash on hand	1	15	Nov. 2	Notebook		19
Nov. 1	Allowance	1	00	Nov. 3	Ice cream		15
Nov. 4	Old paper		65	Nov. 5	Ball-point pen		95
Nov. 6	Raking leaves		75	Nov. 6	Movies		30
				Nov. 8	Cash on hand	1	96
	Total	3	55			3	55
Nov. 8	Cash on hand	1	96				

Pages 48–49

Aim: To reteach the solving of two-step problems and prepare for the solving of three-step problems

Suggestions: *Find the hidden question* is the challenge to the pupil in doing these problems. In fact, the pupil should be required to write the hidden question before he begins to work the problem. In ex. 2 on page 48 the hidden question is, "How much did the 6 handkerchiefs cost?" In addition to having the pupils write the hidden question, remind them to estimate the answer for each step in the problem. *Estimate* the cost of 6 handkerchiefs at 39¢ to be about \$2.40; if this is right, the change must be around \$2.60.

Repeatedly mention the need for estimating an answer before attempting the solution. For the problems on page 49, follow the same plan of writing the hidden question and estimating.

Workbook Reference: Arithmetic Workshop, Book 6, page 19

Key: Page 48 **2.** How much did the 6 handkerchiefs cost? $6 \times \$.39 = \$2.34$; $\$5.00 - \$2.34 = \$2.66$. **3.** How much did the 4 tickets cost? $4 \times \$.65 = \$2.60$; $\$2.60 + \$.60 = \$3.20$. **4.** How many gallons are there in 20 qt.? $20 \div 4 = 5$ (gal.); $5 \times \$2.15 = \$10.75$.

Page 49 **1.** 3 × $.21 = $.63; 30 × $.63 = $18.90. **2.** $3.50 + $3.95 = $7.45; $14.25 − $7.45 = $6.80. **3.** 9:30 A.M. to 12:30 P.M. is 3 hr.; 117 mi. ÷ 3 = 39 mi. **4.** 238 cones + 215 cones + 275 cones + 308 cones = 1036 cones; 1036 cones ÷ 4 = 259 cones. **5.** 2 × $3.50 = $7.00; $7.00 − $6.00 = $1.00. **6.** $18.50 + $9.98 = $28.48; $28.48 ÷ 2 = $14.24. **7.** $1.98 ÷ 6 = $.33; $.39 − $.33 = $.06. **8.** 48 × $.07 = $3.36; $3.36 − $2.00 = $1.36. **9.** 2 × $2.98 = $5.96; $5.96 + $1.79 + $3.59 + $.85 = $12.19. **10.** 9 × 12 = 108 (cookies); 220 − 108 = 112 (cookies). **11.** 3 × $.45 = $1.35; $1.35 − $1.20 = $.15.

Pages 50–52

Aim: To present word problems dealing with insects

Suggestions: Since the numbers in these problems are all large numbers, the pupils may need to review the work on pages 4 and 27 before beginning the unit. Some pupils may remember the problem unit on insects found in *American Arithmetic, Grade 5*. The work on these pages is more detailed and is easily correlated with a science unit. The information is authentic. Pupils might well enrich this material by referring to encyclopedias and other reference books for pictures of these insects and additional information about their ways of living. A picture notebook dealing with this problem unit could easily be developed, and additional discussion periods in science would prove profitable. The United States Department of Agriculture has visual aids for use in such a project. Some pupils might well visit the town or city hall to discover what local projects are being undertaken to control insects in their own community.

Key: Pages 50–51 **1.** 175,000,000 × $20 = $3,500,000,000; no. **2.** (1) 50¢ = $.50, 53,000,000 × $.50 = $26,500,000.00; (2) 75¢ = $.75, 53,000,000 × $.75 = $39,750,000.00. **3.** $789,000,000 ÷ 25 = $31,560,000. **4.** $27,376,000 ÷ 20 = $1,368,800. **5.** $392,140,000.

Page 52 **1.** (1) 686,000 ÷ 25 = 27,440 (da.); (2) 27,440 ÷ 7 = 3920 (wk.); (3) 3920 ÷ 52 = 75 R20, or about 75 (yr.). **2.** $\frac{2}{5}$ × 686,000 = 274,400 (beetles). **3.** $\frac{1}{8}$ × 686,000 = 85,750 (kinds of insects). **4.** (1) 5 yr. + 17 yr. = 22 yr.; (2) 22 yr. + 17 yr. = 39 yr.; (3) 39 yr. + 17 yr. = 56 yr. **5.** 1st time, 13th year; 2d time, 26th year; 3d time, 39th year; 4th time, 52d year. **6.** (1) 100 × 5 ft. = 500 ft.; (2) 40 × 12 ft. = 480 ft.; yes.

Page 53

Aim: To review addition and subtraction process work

Key: **1.** 12,394; 21,497; 27,606; 23,950; 23,295; 17,588. **2.** 29,040; 18,651; 22,271; 23,973; 19,000; 15,083. **3.** 25,931. **4.** 24,427. **5.** 33,000. **6.** 91,764. **7.** $21.64; 575. **8.** $176.25. **9.** 7146 ft. − 5280 ft. = 1866 ft. **10.** $.36. **11.** 20,234; 32,719; 18,663; 76,914; 9865. **12.** 14,959; 15,825; 44,599; 68,078; 20,745. **13.** 19,487; 17,270; 34,887; 47,536; 1242.

Pages 54–58

Aim: To show how to give and score improvement tests

Purpose of Improvement Tests. By the end of the fifth grade most pupils have learned the four fundamental operations with whole numbers. When these pupils come to the sixth grade, it is necessary to give them additional practice with whole numbers in order to maintain and to develop further the skills already learned. Along with this work, the sixth-grade teacher must teach certain new topics, the most important of which are the multiplication and division of common fractions and the four operations with decimals. The task of the sixth-grade teacher, therefore, is a dual one. Unless she carefully plans the review work with whole numbers, she may find that this work takes so much time that it seriously interferes with the new subjects. Further, the mere reviewing of the work learned in the previous grades may be uninteresting and monotonous to the pupils unless some new element is introduced.

In order to give pupils the necessary drill on whole numbers and to do this *in less than 30 minutes a week*, the authors have devised a series of improvement tests, which are described on pages 54–58 and 327–328 of the text. These tests have the additional merit of being very interesting to pupils.

These improvement tests have been used successfully by many hundreds of teachers who are unanimous in their verdict that they are the most effective means yet found of improving the pupil's skill in computation. One important fact about these tests is that the pupils themselves grow more enthusiastic about them the longer they use them, whereas with many other types of tests the interest of the pupils soon dies out.

Description of Improvement Tests. There are 60 improvement tests in this book, and these tests are distributed uniformly over the year's work. These tests are arranged in sets of 3 tests each; hence, there are 20 sets of such tests. The tests cover the addition, subtraction, multiplication, and division of whole numbers. For a complete list of these tests, see the text index under "Improvement Tests." A preliminary orientation concerning these tests is given on page 54 of the text, which should be read carefully at this time. A set of the improvement tests, consisting of 3 addition tests, is shown on page 55. The nature of these tests becomes evident through an examination of the 3 tests. Each test scores 10 points. If a pupil gets a score of 9 on Test 1a and a score of 10 on Test 1b, he has done better on Test 1b than on Test 1a, since the tests are of equal difficulty.

Though there are 3 tests on page 55, these 3 tests should not all be given the same day. Only one test of a set is to be taken on a given day. The reason for this caution is to avoid fatigue and to minimize the time devoted to drill on whole numbers. In general, one test should be given every second or third day; hence, the 3 tests on page 55 will be spread over a period of 5 to 7 days.

The number of exercises in each test is indicated by a small number in a circle, which is printed near the last exercise in the test. For example, at the end of Test 1a on page 55 you find ⑩, which means that there are 10 exercises in this test. On the other hand, on Subtraction Test 1a, given on page 67, there are 15 exercises.

How to Give Improvement Tests. The method of giving improvement tests is described in detail on page 328 of the text. These directions should be studied carefully. In timing the tests, use a watch with a second hand so that the pupils can be stopped promptly at the end of the time assigned to the test. In giving the addition tests on page 55, allow exactly 5 minutes for each test so that the results on these tests may be comparable. If you allow 5 minutes for Test 1a but permit the time for Test 1b to run to $5\frac{1}{2}$ minutes, the results on Test 1b cannot reliably be compared with those on Test 1a. The purpose of these tests is to measure improvement in computing with whole numbers, and this measurement can be made only if the tests are given under the same conditions each time.

In taking an addition test such as those on page 55, the pupils should not copy the examples before working them. Instead, they are to write the answers along the edge of a piece of folded paper, as described on page 56 of the text. Folded paper is used only for the tests on addition and subtraction. For tests on multiplication and division, such as those given on pages 74 and 95, the exercises should be copied on a sheet of paper *before* the test is given. In copying the exercises, the pupils should spread them out over the sheet to allow ample space for the work. The time assigned for a test on multiplication or division is the time actually allowed for taking the test *after* the copying has been completed.

Scoring Tests. All improvement tests are scored on a scale of 10, and the actual scoring is done by the aid of a scoring table, which is described on page 57 of the text. For convenience, this scoring table is printed also on page 329. The pupils must be carefully instructed in using this table to find their scores. A scoring table is not necessary, of course, in scoring addition tests like those on page 55, where there are 10 exercises in each test; but such a table becomes a great convenience in scoring the subtraction tests on page 67, where there are 15 exercises in each test. The table is a real necessity also in scoring the multiplication tests on page 74, where there are only 6 exercises in each test.

Keeping Records. Each pupil should keep a graphic record of his scores on each improvement test, as explained on page 58 of the text. This record should include all tests taken during the school year. A Score Book can easily be made from a few sheets of squared paper. If the school does not have squared paper, a pad of such paper can be purchased cheaply and a few sheets distributed to each pupil. It will be seen in the graph at the top of page 58 that 3 scores are kept for each set of tests. Since there are 20 sets of tests in all, each pupil need have only enough squared paper to provide for the scores on 20 sets.

The plan of having each pupil keep a graphic record of his scores has a very favorable psychological effect upon him. If he finds that his score on the second test of a set is not above that on the first test, he immediately puts forth all his energy to improve his record on the third test. The pupil is always trying to better his previous performance, and this element maintains a high degree of interest in this work throughout the school year. The pupil also gains considerable satisfaction in studying his scores from time to time during the year.

In the middle of the year his scores should be better, in general, than those at the first of the year; and at the end of the year he should be doing still better.

A pupil will find it helpful to compare his scores on subtraction tests with those on addition tests. If he finds that he does not do so well on the subtraction tests as on the addition tests, he will see that he needs more practice on subtraction. Similar comparisons may be made with respect to the tests on multiplication and division.

Key: Page 55 **1.** 1325; 1952; 2000; 1633; 1944. **2.** 1861; 2640; 2628; 1562; 1715. **3.** 1960; 1569; 1811; 1809; 2000. **4.** 2267; 2128; 1774; 2959; 1701. **5.** 2203; 3000; 1845; 2832; 2830. **6.** 3072; 2176; 1603; 1364; 1707.

Page 58 **2.** 10 on Nov. 5. **3.** 7 on Nov. 12; 9 on Nov. 16; 8 on Nov. 18.

Page 59

Aims: To review meanings in relation to common fractions and to review the fundamental principle of fractions

Suggestions: The work on fractions on pages 59–66, 68–71, and 75–78 is a review of the work on fractional meanings and on the addition and subtraction of fractions given in the fifth grade. In ex. 1 on page 59, emphasize the fact that a fraction like $\frac{3}{4}$ may represent a part of one thing, or a part of a group of things, or it may indicate the division of two numbers. The terms *numerator* and *denominator* need careful review. Ex. 3 shows how a fraction like $\frac{3}{4}$ can be changed to another fraction like $\frac{9}{12}$ by multiplying both terms of $\frac{3}{4}$ by 3. Ex. 3 shows also how $\frac{9}{12}$ can be changed back to $\frac{3}{4}$ by dividing both terms of $\frac{9}{12}$ by 3. This work involves the use of a fundamental principle of fractions which is stated in the box at the bottom of page 59. This fundamental principle is constantly used throughout all the work on fractions and should, therefore, be thoroughly understood. The important thing about this principle is that it shows how to change a fraction to another fraction having the *same value*. This process of changing one fraction to another one corresponds to changing a dime to 2 nickels, or a half dollar to 5 dimes. In changing a dime to 2 nickels, there is no change in the value represented, but there is a change in the form. Likewise, in changing $\frac{3}{4}$ to $\frac{9}{12}$, there is no change in value, but there is a change in the form of the fraction.

Workbook Reference: Arithmetic Workshop, Book 6, page 16

Pages 60–61

Aim: To review simplification of fractions

Suggestions: The work on these two pages is very important since it is preparatory to the work on the addition and subtraction of fractions given on the subsequent pages. On page 60, ex. 7–14 apply the fundamental principle of fractions given on page 59. On page 61, the terms *proper fraction, improper fraction,* and *mixed numbers* must be fully reviewed. Ex. 5 on page 61 is important in that it shows how a whole number like 6 may be written in the form of a fraction such as $\frac{6}{1}$. In later work in fractions it may be convenient to write a whole number in the form of a fraction having 1 as the denominator.

Workbook Reference: Arithmetic Workshop, Book 6, page 17

Key: Page 60 **1.** 9. **2.** $\frac{8}{16}$ lb., or $\frac{1}{2}$ lb. **3.** $\frac{45}{60}$ hr., or $\frac{3}{4}$ hr. **4.** $\frac{16}{32}$ bu., or $\frac{1}{2}$ bu. **5.** $\frac{72}{120}$, or $\frac{3}{5}$. **6.** $\frac{9}{12}$ yr., or $\frac{3}{4}$ yr. **7.** 2; 10; 8; 25; 75. **8.** 2; 8; 10; 14; 60. **9.** 6; 4; 4; 15; 50. **10.** 3; 5; 14; 3; 90. **11.** $\frac{2}{5}$, 2; $\frac{1}{3}$, 6; $\frac{1}{2}$, 8; $\frac{3}{4}$, 9; $\frac{3}{5}$, 5; $\frac{2}{3}$, 5; $\frac{2}{3}$, 10; $\frac{3}{5}$, 10; $\frac{1}{2}$, 50. **12.** $\frac{3}{4}$, 4; $\frac{5}{6}$, 4; $\frac{1}{2}$, 16; $\frac{5}{9}$, 2; $\frac{3}{4}$, 5; $\frac{1}{5}$, 8; $\frac{5}{6}$, 10; $\frac{3}{4}$, 20; $\frac{3}{5}$, 20. **13.** $\frac{2}{3}$, 4; $\frac{4}{5}$, 3; $\frac{3}{4}$, 6; $\frac{1}{4}$, 8; $\frac{7}{8}$, 2; $\frac{3}{4}$, 3; $\frac{1}{2}$, 10; $\frac{5}{8}$, 5; $\frac{3}{4}$, 25. **14.** $\frac{4}{5}$, 4; $\frac{5}{6}$, 2; $\frac{2}{3}$, 12; $\frac{2}{9}$, 2; $\frac{5}{16}$, 2; $\frac{1}{2}$, 30; $\frac{2}{3}$, 30; $\frac{1}{2}$, 25; $\frac{7}{20}$, 5.

Page 61 **5.** $\frac{3}{1}$. **6.** Proper fractions: $\frac{2}{5}$, $\frac{10}{16}$, $\frac{1}{2}$, $\frac{7}{12}$, $\frac{14}{16}$; improper fractions: $\frac{7}{7}$, $\frac{12}{4}$, $\frac{18}{5}$, $\frac{12}{12}$. **7.** 1; $2\frac{1}{2}$; 2; $2\frac{2}{5}$; $1\frac{5}{12}$; $2\frac{2}{5}$; 1; 3; $3\frac{1}{3}$. **8.** $1\frac{4}{5}$; 2; $1\frac{1}{2}$; $2\frac{1}{2}$; $1\frac{1}{4}$; $3\frac{1}{8}$; $2\frac{2}{3}$; $4\frac{5}{6}$; $5\frac{1}{2}$. **9.** 2; $4\frac{1}{6}$; $1\frac{3}{8}$; 3; $1\frac{1}{2}$; $2\frac{1}{3}$; $1\frac{1}{3}$; $6\frac{2}{3}$; $2\frac{5}{8}$.

Pages 62–65

Aim: To review the addition of fractions taught in Grade 5

Suggestions: Before assigning the exercises on page 62, have the pupils study the model example in ex. 1 and the model examples in ex. 2. Emphasize the fact that fractions having different denominators must be changed to equal fractions with the *same denominator* before they can be added. In the exercises on pages 62–65, notice that some of the exercises have like denominators while other exercises have unlike denominators. In most of the exercises in which the denominators are unlike, the common denominator is the same as the denominator of one of the fractions; hence, only one of the fractions needs to be changed. For example, in an exercise like $8\frac{3}{8} + 4\frac{1}{4}$, the common denominator is 8, which is the same as the denominator of $\frac{3}{8}$; hence, only the fraction $\frac{1}{4}$ has to be changed. In only a few cases, such as $7\frac{1}{2} + 8\frac{1}{3}$, is it necessary to change both fractions before adding them; then the common denominator, which is 6, is usually found by inspection.

Workbook Reference: Arithmetic Workshop, Book 6, page 18

Key: Page 62 **3.** $\frac{2}{5}$; $\frac{1}{3}$; 6; $7\frac{1}{2}$; 8; $13\frac{1}{3}$; $4\frac{1}{3}$. **4.** $\frac{1}{4}$; 1; $6\frac{1}{2}$; $10\frac{1}{2}$; $3\frac{1}{5}$; $10\frac{1}{4}$; 7. **5.** $\frac{5}{8}$; $1\frac{1}{4}$; $6\frac{3}{4}$; $7\frac{7}{8}$; $7\frac{15}{16}$; $15\frac{1}{3}$; $13\frac{3}{4}$.

Page 63 **1.** 6 lb. **2.** $4\frac{1}{2}$ lb. **3.** $15\frac{2}{10}$ mi. or $15\frac{1}{5}$ mi. **4.** 7 hr. **5.** $1\frac{1}{2}$ cups. **6.** $7\frac{3}{8}$ lb. **7.** 1; $\frac{3}{4}$; 7; $8\frac{1}{2}$; 10; $14\frac{1}{2}$; $8\frac{2}{3}$. **8.** $1\frac{1}{2}$; 1; $11\frac{2}{3}$; $9\frac{3}{5}$; $8\frac{2}{3}$; $5\frac{1}{8}$; $12\frac{1}{3}$. **9.** $1\frac{1}{3}$; $\frac{1}{4}$; 7; $7\frac{3}{4}$; $18\frac{3}{4}$; $8\frac{1}{2}$; 6. **10.** $1\frac{3}{4}$; $1\frac{5}{6}$; $16\frac{1}{4}$; $16\frac{9}{10}$; $14\frac{9}{16}$; $14\frac{1}{10}$; $10\frac{4}{5}$.

Page 64 **3.** $9\frac{3}{4}$; $10\frac{13}{16}$; $11\frac{3}{8}$; $14\frac{13}{16}$; $6\frac{7}{12}$; $11\frac{3}{16}$; $15\frac{5}{6}$. **4.** $7\frac{7}{8}$; $6\frac{1}{16}$; $6\frac{5}{6}$; $8\frac{1}{2}$; $11\frac{13}{16}$; $8\frac{1}{3}$; $10\frac{1}{6}$. **5.** 11; $13\frac{3}{4}$; $17\frac{3}{8}$; $14\frac{1}{4}$; 8; $15\frac{7}{16}$; $11\frac{5}{6}$.

Page 65 **1.** $3\frac{5}{8}$ yd. **2.** $2\frac{3}{4}$ lb. **3.** $11\frac{1}{16}$ in. **4.** 1; $9\frac{2}{3}$; $10\frac{5}{12}$; $4\frac{9}{10}$; $7\frac{1}{4}$; $13\frac{5}{16}$; $14\frac{7}{8}$. **5.** $1\frac{1}{2}$; $7\frac{3}{4}$; $8\frac{5}{8}$; $6\frac{4}{5}$; $9\frac{9}{10}$; $8\frac{9}{16}$; $12\frac{4}{5}$. **6.** $1\frac{5}{8}$; $9\frac{1}{4}$; $11\frac{5}{8}$; $15\frac{1}{5}$; $13\frac{9}{16}$; 7; $5\frac{9}{16}$. **7.** $2\frac{3}{8}$; $14\frac{15}{16}$; $16\frac{7}{8}$; $14\frac{1}{12}$; $11\frac{11}{16}$; $20\frac{2}{3}$; $15\frac{2}{5}$.

Page 66

Aim: To review the subtraction of fractions

Suggestions: In the exercises on this page the fraction in the minuend is always larger than or equal to the fraction in the subtrahend; hence, no regrouping is necessary. Attention is called to the fact that the exercises on this page are to be checked by going over the work a second time.

Workbook Reference: Arithmetic Workshop, Book 6, page 20

Key: **2.** $3\frac{1}{4}$ hr. **3.** $2\frac{5}{8}$ lb. **4.** $\frac{1}{2}$; $\frac{3}{5}$; $\frac{3}{8}$; $\frac{5}{12}$; $\frac{3}{8}$. **5.** $\frac{3}{4}$; $\frac{1}{2}$; $\frac{1}{4}$; $\frac{7}{16}$; $\frac{1}{6}$. **6.** $2\frac{1}{2}$; $3\frac{1}{4}$; $5\frac{2}{3}$; $3\frac{1}{5}$; $2\frac{3}{10}$; $1\frac{1}{6}$; $7\frac{1}{4}$. **7.** $1\frac{3}{4}$; $4\frac{1}{4}$; $2\frac{5}{8}$; $3\frac{11}{16}$; $5\frac{1}{2}$; $2\frac{3}{10}$; $3\frac{1}{2}$. **8.** $\frac{1}{8}$; $6\frac{1}{6}$; $4\frac{5}{12}$; $2\frac{5}{16}$; $3\frac{1}{2}$; $4\frac{1}{6}$; $\frac{1}{8}$. **9.** $5\frac{1}{10}$; $2\frac{1}{16}$; $4\frac{5}{12}$; $2\frac{1}{12}$; $4\frac{1}{10}$; $7\frac{1}{8}$; $2\frac{1}{6}$. **10.** $4\frac{1}{8}$; $1\frac{1}{5}$; 4; $5\frac{7}{16}$; $7\frac{5}{12}$; $7\frac{1}{12}$; $4\frac{3}{8}$.

Page 67

Aim: To present the first set of improvement tests in the subtraction of whole numbers

Suggestion: This page presents a set of three improvement tests on subtraction. These tests are to be given in the same manner as the improvement tests on addition on page 55.

Key: **1.** 2227; 6144; 6865; 835; 1353. **2.** 1569; 2257; 1960; 889; 1504. **3.** 1943; 2183; 5454; 3298; 4787. **4.** 3507; 3104; 3966; 2829; 170. **5.** 4639; 3216; 4970; 632; 1932. **6.** 1174; 2936; 4752; 4968; 1427. **7.** 1305; 548; 2556; 7366; 1945. **8.** 2886; 713; 887; 4414; 1920. **9.** 984; 1579; 1373; 2697; 944.

Pages 68–71

Aim: To review the subtraction of fractions in which the fraction in the minuend is less than the fraction in the subtrahend

Suggestions: Page 68 reteaches the steps needed to be taken when a fraction is to be subtracted from a smaller fraction. In whole numbers, this process was called *regrouping*. In whole numbers when you borrow from the tens place, you are in reality exchanging 1 ten for 10 ones. Here in fractions the same thing takes place when 1 whole is exchanged for $\frac{4}{4}$, $\frac{6}{6}$, and so on. In ex. 6–12, dollars are changed into quarters, halves, tenths, and so on. Beginning with ex. 13, the more abstract operation is noted. If pupils have trouble with this idea, review with them the number of fourths in 1, the number of thirds in 1, and so on.

Page 69 applies the skill learned on page 68 to examples in which mixed numbers are being subtracted from whole numbers. Insist that pupils show the true equality and explain why $10 = 9\frac{2}{2}$.

Page 70 takes the operation one step farther and requires pupils to subtract mixed numbers from mixed numbers. Ask the pupils to write out the examples as shown in ex. 1 and 2.

Page 71 extends the practice of this skill. If the pupils demonstrate an adequate mastery of the work on page 70, they should be excused from doing the work on page 71.

Workbook Reference: Arithmetic Workshop, Book 6, pages 22 and 23

Key: Page 68 **1.** Yes. **2.** Yes. **3.** Yes. **4.** Yes. **5.** Yes. **6.** 4; 4. **7.** 2; 2. **8.** 10; 10. **9.** 5; 5. **10.** 3; 3. **11.** 15; 15. **12.** 6; 6. **13.** 4; 7; 13; 10. **14.** 2; 15; 21; 12. **15.** 3; 8; 13; 6, 14. **16.** 8; 5; 25; 5, 15. **17.** 10; 4; 17; 3, 15.

Page 69 **3.** $2\frac{1}{2}$ lb. **5.** $2\frac{1}{2}$; $\frac{1}{3}$; $2\frac{1}{2}$; $6\frac{1}{2}$; $4\frac{7}{8}$; $3\frac{1}{4}$; $6\frac{1}{2}$.

Page 70 **3.** $\frac{3}{4}$ in. **4.** $5\frac{2}{3}$; $5\frac{1}{2}$; $\frac{11}{12}$; $3\frac{9}{10}$; $6\frac{3}{8}$; $\frac{3}{4}$; $2\frac{5}{6}$. **5.** $\frac{3}{4}$; $1\frac{15}{16}$; $1\frac{11}{16}$; $3\frac{5}{8}$; $5\frac{1}{3}$; $2\frac{15}{16}$; $5\frac{1}{6}$. **6.** $3\frac{7}{8}$; $\frac{9}{10}$; $3\frac{1}{3}$; $2\frac{3}{4}$; $3\frac{1}{2}$; $6\frac{11}{16}$; $3\frac{3}{8}$. **7.** $1\frac{7}{12}$; $3\frac{13}{16}$; $3\frac{11}{16}$; $4\frac{5}{8}$; $1\frac{2}{3}$; $\frac{4}{5}$; $\frac{7}{10}$.

Page 71 **1.** $2\frac{3}{10}$ sec. **2.** $10\frac{9}{10}$ sec.; $13\frac{1}{5}$ sec. **3.** $1\frac{4}{5}$ sec. **4.** $5\frac{3}{4}$; $2\frac{1}{4}$; $4\frac{5}{8}$; $7\frac{11}{16}$; $4\frac{3}{4}$; $\frac{5}{16}$; $4\frac{3}{4}$. **5.** $4\frac{2}{3}$; $4\frac{3}{4}$; $3\frac{5}{6}$; $\frac{7}{12}$; $6\frac{5}{8}$; $2\frac{15}{16}$; $2\frac{4}{5}$. **6.** $1\frac{15}{16}$; $1\frac{11}{12}$; $1\frac{5}{6}$; $\frac{3}{10}$; $2\frac{3}{4}$; $3\frac{1}{4}$; $4\frac{7}{12}$. **7.** $4\frac{3}{5}$; $4\frac{5}{8}$; $2\frac{3}{4}$; $\frac{9}{10}$; $4\frac{1}{2}$; $\frac{7}{12}$; $2\frac{11}{16}$. **8.** $2\frac{1}{12}$; $\frac{7}{10}$; $3\frac{11}{24}$; $\frac{11}{16}$; $1\frac{2}{5}$; $1\frac{5}{12}$; $4\frac{15}{16}$.

Pages 72–73

Aim: To teach how to solve three-step problems

Suggestion: The method of solving three-step problems is fully explained in the model example at the top of page 72. Make clear to the pupils that in solving any three-step problem they must answer three questions. Two of these questions are *hidden questions,* while the third question is the one actually asked in the problem.

Workbook Reference: Arithmetic Workshop, Book 6, page 24

Key: Page 72 **2.** 3 × \$1.25 = \$3.75; 2 × \$.79 = \$1.58; \$3.75 + \$1.58 = \$5.33. **3.** 3 × \$.95 = \$2.85; \$2.85 + \$.35 + \$.45 = \$3.65; \$8.50 − \$3.65 = \$4.85. **4.** 452 cookies − 8 cookies = 444 cookies; 444 ÷ 12 = 37 (doz. cookies); 37 × \$.45 = \$16.65. **5.** $\frac{1}{2}$ × 452 = 226 (chocolate cookies); 100 + 226 = 326 (cookies); 452 − 326 = 126 (sugar cookies).

Page 73 **1.** \$4.50 − \$2.95 = \$1.55; \$5.00 − \$3.75 = \$1.25; \$1.55 − \$1.25 = \$.30. The saving was \$.30 larger on the first book. **2.** $\frac{7}{8}$ × \$.56 = \$.49; \$.49 + \$1.85 = \$2.34; \$3.00 − \$2.34 = \$.66. **3.** \$25.00 + \$9.50 = \$34.50; $\frac{1}{3}$ × \$34.50 = \$11.50; \$34.50 − \$11.50 = \$23.00. **4.** $\frac{3}{4}$ × \$.60 = \$.45; 4 × \$1.19 = \$4.76; \$.45 + \$.50 + \$4.76 = \$5.71. **5.** $\frac{1}{2}$ × \$8.50 = \$4.25; \$1.59 + \$1.19 = \$2.78; \$4.25 − \$2.78 = \$1.47. **6.** \$35.00 − \$23.10 = \$11.90; \$.25 + \$.45 = \$.70; 1190¢ ÷ 70¢ = 17(wk.). **7.** 6 × \$.59 = \$3.54; \$3.54 + \$1.95 = \$5.49; \$10.00 − \$5.49 = \$4.51. **8.** \$68.75 + \$77.95 = \$146.70; \$146.70 ÷ 9 = \$16.30; $\frac{1}{2}$ × \$16.30 = \$8.15.

Page 74

Aim: To present the first set of improvement tests in multiplication and a review of whole numbers and fractions

Suggestions: At the top of the page a set of three improvement tests in multiplication is given. These tests are to be given in the same manner as the improvement tests in addition on page 55. Since the tests on page 74 are multiplication tests, they must be copied *before* the test is given. In copying, the pupils should spread out the examples so that there will be ample space for working each one. The time allowance of 4 min. for each test is the time allowed *after* the test begins. This time does not include the time spent in copying. The multiplication tests should be scored and recorded in the same manner as the addition tests. The bottom half of the page contains 56 examples in mixed drill.

Key: **1.** 13,410; 56,025; 28,221; 13,932; 71,475; 35,604. **2.** 49,474; 7708; 5244; 32,568; 26,598; 28,835. **3.** 47,796; 38,902; 14,800; 61,110; 14,586; 32,838. **4.** 8337; 3043; 43,300; $11\frac{1}{2}$; $13\frac{7}{8}$; $9\frac{1}{2}$. **5.** 3726; 8645; 59,943; $6\frac{1}{3}$; 12; $7\frac{3}{10}$. **6.** 1079, 1149, 35,644, $5\frac{9}{10}$, $3\frac{5}{8}$, $2\frac{7}{8}$; 190, 3355, 26,467, $3\frac{1}{6}$, $2\frac{1}{4}$, $4\frac{3}{10}$. **7.** 287,712; 105,339; 493,987; 48. **8.** 822,649; 408,320; 171,028; 84. **9.** 475,410; 147,730;

86,016; 60. **10.** 315, 386, 655, 720 R4, 867 R10; 160 R35, 196 R46, 334 R9, 367 R21, 442 R27. **11.** 154 R24, 213 R16, 686, 923, 566 R11; 79 R3, 109, 350, 470 R45, 289.

Pages 75–78

Aim: To teach an efficient method of finding the least common denominator

Suggestion: Although this skill was taught in Grade 5, it will be necessary to plan a complete reteaching of it in Grade 6.

Workbook Reference: Arithmetic Workshop, Book 6, page 25

Key: Page 75 **2.** $\frac{5}{24}$; $9\frac{11}{20}$; $10\frac{23}{24}$; $7\frac{11}{12}$; $14\frac{23}{24}$; $7\frac{17}{20}$; $10\frac{1}{12}$. **3.** $1\frac{13}{20}$; $7\frac{8}{15}$; $11\frac{7}{24}$; $9\frac{19}{24}$; $11\frac{13}{40}$; $5\frac{1}{20}$; $11\frac{5}{12}$. **4.** $\frac{33}{40}$; $11\frac{1}{15}$; $8\frac{5}{24}$; $12\frac{5}{12}$; $7\frac{7}{20}$; $6\frac{1}{24}$; $15\frac{13}{24}$. **5.** $1\frac{11}{24}$; $14\frac{7}{40}$; $6\frac{7}{12}$; $13\frac{17}{24}$; $9\frac{9}{20}$; $4\frac{19}{40}$; $16\frac{11}{24}$. **6.** $1\frac{11}{40}$; $8\frac{1}{20}$; $4\frac{1}{24}$; $7\frac{7}{12}$; $13\frac{13}{24}$; $11\frac{23}{24}$; $9\frac{5}{12}$.

Page 76 **2.** $1\frac{1}{24}$; $13\frac{11}{12}$; $4\frac{11}{40}$; $6\frac{5}{24}$; $7\frac{17}{24}$; $11\frac{23}{24}$; $9\frac{5}{12}$. **3.** $1\frac{1}{24}$; $5\frac{7}{12}$; $6\frac{7}{8}$; $7\frac{17}{24}$; $11\frac{1}{8}$; $10\frac{14}{15}$; $14\frac{5}{24}$. **4.** $1\frac{11}{24}$; $8\frac{1}{4}$; $8\frac{7}{15}$; $10\frac{7}{8}$; $14\frac{13}{24}$; $17\frac{9}{20}$; $21\frac{17}{24}$.

Page 77 **2.** $\frac{17}{24}$; $2\frac{15}{16}$; $4\frac{5}{12}$; $4\frac{14}{15}$; $4\frac{13}{20}$; $4\frac{7}{15}$; $4\frac{3}{8}$. **3.** $\frac{1}{12}$; $3\frac{9}{20}$; $3\frac{7}{12}$; $5\frac{13}{24}$; $1\frac{19}{20}$; $3\frac{27}{40}$; $3\frac{5}{12}$. **4.** $\frac{1}{8}$; $3\frac{3}{16}$; $8\frac{7}{24}$; $3\frac{1}{12}$; $\frac{1}{2}$; $2\frac{15}{16}$; $3\frac{1}{2}$. **5.** $\frac{17}{24}$; $\frac{17}{24}$; $2\frac{7}{8}$; $2\frac{3}{40}$; $2\frac{7}{12}$; $4\frac{2}{3}$; $5\frac{1}{6}$. **6.** $\frac{7}{12}$; $2\frac{1}{5}$; $\frac{7}{10}$; $6\frac{8}{15}$; $1\frac{7}{16}$; $2\frac{13}{24}$; $7\frac{5}{8}$. **7.** $\frac{7}{12}$; $3\frac{3}{5}$; $5\frac{3}{8}$; $2\frac{3}{4}$; $1\frac{9}{20}$; $1\frac{17}{20}$; $1\frac{7}{12}$.

Page 78 **1.** $10\frac{7}{12}$ hr. **2.** $12\frac{1}{8}$ lb. **3.** $15\frac{3}{8}$ mi. **4.** $86\frac{1}{4}$ lb. + $79\frac{3}{4}$ lb. + $89\frac{1}{2}$ lb. + $80\frac{1}{2}$ lb. = 336 lb.; 336 lb. ÷ 4 = 84 lb. **5.** $1\frac{7}{24}$; $13\frac{1}{8}$; $7\frac{5}{16}$; $7\frac{11}{12}$; $7\frac{1}{2}$; $11\frac{1}{2}$; $9\frac{1}{12}$. **6.** $1\frac{11}{12}$; $6\frac{11}{12}$; $12\frac{11}{12}$; $7\frac{3}{8}$; $9\frac{15}{16}$; $16\frac{1}{8}$; $16\frac{1}{15}$. **7.** $1\frac{1}{24}$; $4\frac{5}{8}$; $11\frac{1}{5}$; $4\frac{19}{20}$; $10\frac{5}{6}$; 8; $6\frac{5}{8}$. **8.** $2\frac{7}{24}$; $11\frac{1}{24}$; $11\frac{7}{12}$; $17\frac{9}{16}$; $12\frac{13}{24}$; $17\frac{1}{12}$; $14\frac{3}{4}$.

Page 79

Aim: To present problems dealing with the gathering and selling of fruit

Suggestions: Many rural pupils at this time of year will be engaged in helping to harvest the apple crop. Also, some will be selling apples at roadside stands. The baskets referred to in these examples are usually bushel baskets. The last problem deals with honey, and some pupils will probably suggest that in the fall of the year the hives cannot be "stripped" of honey since a great deal is needed to feed the bees during the long winter ahead.

Key: **1.** 627 + 1485 + 1274 + 2986 = 6372 (baskets). **2.** 536 × \$2.25 = \$1206.00. **3.** 2 × \$1.95 = \$3.90; 4 × 10¢ = 40¢ or \$.40; \$3.90 − \$.40 = \$3.50. **4.** 428 × \$1.75 = \$749.00. **5.** \$52.20 ÷ 36 = \$1.45. **6.** $2\frac{1}{2}$ hr. + $2\frac{1}{4}$ hr. + $6\frac{3}{4}$ hr. = $11\frac{1}{2}$ hr. **7.** $1\frac{3}{4}$ hr. + $2\frac{1}{2}$ hr. = $4\frac{1}{4}$ hr.; 10 hr. − $4\frac{1}{4}$ hr. = $5\frac{3}{4}$ hr. **8.** 12 oz. = $\frac{12}{16}$ lb. = $\frac{3}{4}$ lb.

Page 80

Aim: To review the addition and subtraction of common fractions

Key: **1.** $47\frac{1}{5}$ sec. − $43\frac{4}{5}$ sec. = $3\frac{2}{5}$ sec. **2.** $87\frac{5}{8}$ lb. − $73\frac{3}{4}$ lb. = $13\frac{7}{8}$ lb. **3.** $\frac{3}{4} + 3\frac{1}{2} + 2\frac{1}{4} + 6 = 12\frac{1}{2}$ (cups). **4.** $62\frac{1}{2}$ lb. + $61\frac{3}{4}$ lb. + $59\frac{5}{8}$ lb. = $183\frac{7}{8}$ lb. **5.** 9; $8\frac{1}{8}$; $12\frac{1}{12}$; $8\frac{13}{16}$; $10\frac{7}{20}$; $9\frac{1}{8}$; $8\frac{3}{4}$. **6.** $10\frac{1}{4}$; $11\frac{17}{24}$; $10\frac{17}{24}$; $14\frac{2}{3}$; $14\frac{13}{16}$; $14\frac{1}{4}$; $9\frac{19}{24}$. **7.** $6\frac{5}{8}$; $2\frac{1}{12}$; $4\frac{11}{12}$; $1\frac{1}{16}$; $1\frac{1}{2}$; $7\frac{9}{16}$; $1\frac{17}{24}$. **8.** $3\frac{5}{6}$; $1\frac{3}{8}$; $5\frac{11}{12}$; $2\frac{7}{10}$; $4\frac{1}{4}$; $3\frac{13}{15}$; $2\frac{4}{5}$. **9.** $4\frac{1}{10}$; $2\frac{7}{24}$; $4\frac{2}{3}$; $\frac{1}{3}$; $1\frac{9}{20}$; $\frac{1}{4}$; $1\frac{3}{4}$.

Page 81

Aim: To present problems which contain extra facts

Suggestions: In Chapter 1 the pupils were asked to create questions for problems. This activity required them to think critically about data and questions. The exercise on page 81 continues the training in discriminate thinking. It provides pupils with more facts than are necessary and requires them to determine which facts are relevant and which are irrelevant. This work requires critical thinking. Many problems which adults face in real life contain facts that have no bearing on the situation at hand. People are required to separate the sheep from the goats. Encourage pupils to think critically about all problems which they face.

Workbook Reference: Arithmetic Workshop, Book 6, page 13

Key: **1.** $60\frac{1}{4}$ in. − $57\frac{3}{4}$ in. = $2\frac{1}{2}$ in. **2.** $1\frac{1}{2}$ and $2\frac{1}{2}$ not needed; \$5.25 + \$7.50 = \$12.75. **3.** 3 not needed; 486 ÷ 36 = $13\frac{1}{2}$ (yd.). **4.** 52 not needed; 135 mi. ÷ 3 = 45 mi. **5.** \$2.25 not needed; 10 × \$.75 = \$7.50. **6.** 80 not needed; 36 × \$.20 = \$7.20; 44 × \$.15 = \$6.60; \$7.20 + \$6.60 = \$13.80. **7.** 875 not needed; 16 gal. + 35 gal. = 51 gal.; 51 gal. − 5 gal. = 46 gal. **8.** \$97.00 not needed; 3 × \$28.50 = \$85.50.

Page 82

Aim: To review the major aims of Chapter 2

Suggestions: This test reviews 5 of the 7 major aims as listed in the Teacher's Guide at the beginning of Chapter 2. These are:

Chapter Review	*Aim Number*
Ex. 1–4, 11–13	2
Ex. 5	4
Ex. 6	3 and 4
Ex. 8	6
Ex. 7, 9, 10	7

Key: **1.** Proper fractions: $\frac{5}{8}$; $\frac{11}{12}$; $\frac{10}{15}$; $\frac{9}{10}$; improper fractions: $\frac{5}{3}$; $\frac{12}{4}$; $\frac{27}{8}$; $\frac{24}{3}$. **2.** $\frac{2}{3}$; $\frac{7}{8}$; $\frac{3}{4}$; $\frac{5}{6}$; $\frac{7}{8}$; $\frac{5}{8}$. **3.** $3\frac{1}{3}$; $2\frac{1}{3}$; $5\frac{3}{8}$; $6\frac{2}{5}$; $3\frac{3}{4}$. **4.** $\frac{8}{12}$; $\frac{6}{12}$; $\frac{2}{12}$; $\frac{9}{12}$; $\frac{4}{12}$; $\frac{3}{12}$; $\frac{10}{12}$. **5.** 12, $\frac{5}{12}$; 20, $\frac{17}{20}$; 24, $1\frac{7}{24}$; 12, $2\frac{5}{12}$. **6.** $8\frac{7}{8}$; 12; $9\frac{1}{4}$; $9\frac{3}{5}$; $14\frac{5}{6}$; $9\frac{11}{20}$; $12\frac{5}{16}$. **7.** $2\frac{3}{4}$ yd. + $1\frac{7}{8}$ yd. + $\frac{3}{8}$ yd. = 5 yd. **8.** \$1.47 + \$1.50 + \$.75 + \$2.25 = \$5.97; \$.28 + \$.79 + \$1.25 + \$.19 + \$1.07 = \$3.58; \$5.97 − \$3.58 = \$2.39. **9.** 2 × \$.79 = \$1.58; 3 × \$.49 = \$1.47; \$1.58 + \$1.47 = \$3.05. **10.** 3 × \$1.39 = \$4.17; 2 × \$.98 = \$1.96; \$4.17 + \$1.96 = \$6.13. **11.** 6; 9; 19; 10, 26. **12.** 2; 8; 17; 10, 22. **13.** 4; 5; 17; 4, 14.

Page 83

Aim: To present Problem Test 2

Suggestion: Remind the pupils to graph their scores after completing the test.

Workbook Reference: Arithmetic Workshop, Book 6, page 31

Key: **1.** 10 ft. − $1\frac{3}{4}$ ft. = $8\frac{1}{4}$ ft. **2.** 20 × \$.55 = \$11.00; \$11.00 − \$9.40 = \$1.60. **3.** \$.30 + \$.09 + \$.09 = \$.48; 5 × \$.48 = \$2.40. **4.** 8350 ft. − 5280 ft. = 3070 ft.

5. $75 \div 3 = 25$ (yd.); $25 \times \$.15 = \$3.75$. **6.** $2\frac{3}{4}$ hr. + 3 hr. + $2\frac{1}{2}$ hr. + $2\frac{1}{4}$ hr. = $10\frac{1}{2}$ hr. **7.** $28 \times \$.63 = \$17.64$; $\$17.64 \div 36 = \$.49$. **8.** $3 \times \$.55 = \$1.65$; $\$2.00 - \$1.65 = \$.35$; 35¢ ÷ 5¢ = 7 (pencils). **9.** $473 \times \$.35 = \$165.55$. **10.** 1 bu. = 32 qt.; $32 \times \$.15 = \$4.80$; $\$4.80 - \$3.75 = \$1.05$.

Page 84

Aim: To give a diagnostic test with page references for remedial work

Suggestions: The value of this diagnostic test cannot be overemphasized. The work on fractions is carefully developed, and adequate practice is suggested for pupils who do not make a satisfactory score.

Workbook Reference: Arithmetic Workshop, Book 6, page 32

Key: **1.** $\frac{1}{2}$; $\frac{4}{5}$; $\frac{3}{4}$; $\frac{5}{8}$; $\frac{3}{4}$. **2.** $2\frac{3}{4}$; $2\frac{1}{2}$; $3\frac{3}{5}$; $3\frac{2}{5}$; $2\frac{1}{2}$. **3.** 3; 5; 8, 24. **4.** 5; 11; 10, 22. **5.** 5; $3\frac{3}{4}$; $7\frac{2}{3}$; $7\frac{1}{2}$; 10. **6.** $3\frac{1}{2}$; $3\frac{1}{12}$; $11\frac{1}{6}$; $8\frac{1}{16}$; $7\frac{1}{4}$. **7.** $6\frac{1}{24}$; $10\frac{1}{12}$; $4\frac{11}{24}$; $8\frac{19}{24}$; $7\frac{7}{20}$. **8.** $5\frac{3}{4}$; $7\frac{3}{10}$; $3\frac{5}{8}$; $1\frac{1}{2}$; $4\frac{7}{16}$. **9.** $2\frac{2}{3}$; $2\frac{1}{2}$; $5\frac{1}{2}$; $1\frac{3}{5}$; $3\frac{2}{3}$.

Chapter 3

Aims of Chapter 3. The major aims of Chapter 3 are to:

1. Review the basic skills and understandings taught in previous chapters.
2. Reteach the multiplication of a whole number by a fraction or a mixed number and the reverse.
3. Teach multiplication of a fraction by a fraction in which cancellation may or may not be involved.
4. Teach the true meaning of cancellation as division.
5. Reteach the changing of a mixed number to an improper fraction.
6. Teach the multiplication of a mixed number by a fraction and reverse.
7. Teach the multiplication of a mixed number by a mixed number.
8. Reteach linear measure and extend to include the *rod.*
9. Reteach what perimeter and area mean and how to calculate them (no formula shown).
10. Show what a square inch, a square foot, and a square yard mean and the relationships which exist between them.
11. Present the table of square measure which includes the acre and the square mile.

Pages 85–86

Aim: To present problems dealing with forest conservation

Suggestions: The problems on these pages deal with the causes and results of forest fires. Most states have active programs of forest-fire prevention and control. Before starting these problems, some pupils may give firsthand information on what your state or a neighboring state is doing for forest-fire prevention. Other data concerning forest fires are found in *The World Almanac* or in articles in daily newspapers or weekly magazines. Ex. 7, page 86, provides excellent motivation for a round-table or panel discussion in a social-studies class.

Key: Page 85 **1.** \$29,000,000 is about \$30,000,000; 573,000,000 is about 600,000,000; \$30,000,000 ÷ 600,000,000 = \$$\frac{1}{20}$ or 5¢. **2.** \$54,000,000 is about \$55,000,000; 761,000,000 is about 800,000,000; \$55,000,000 ÷ 800,000,000 = \$$\frac{7}{10}$ or 7¢. **3.** \$57,000,000 − \$29,000,000 = \$28,000,000; \$28,000,000 ÷ 10 = \$2,800,000.

Page 86 **1.** 104,622 − 86,737 = 17,885 (fires). **2.** 208,400 − 104,622 = 103,778; about 2 times. **3.** 4,155,000 − 2,578,000 = 1,577,000 (acres). **4.** 104,622 ÷ 6 = 17,437 (fires). **5.** 104,622 ÷ 12 = 8,718$\frac{1}{2}$, or about 8,719 (fires). **6.** $\frac{1}{4} + \frac{1}{6} = \frac{5}{12}$. **7.** 311,000 ÷ 11 = 28,272$\frac{8}{11}$ (acres).

Page 87

Aim: To find a fractional part of a whole number

Suggestions: The work of finding a fractional part of a whole number, such as finding $\frac{3}{4}$ of 84, is regarded as a topic in the multiplication of fractions and is probably more often used in practical life than any other type of work in multiplying fractions. Ex. 2 on page 87 points out that the sign × means "of" when it is written after a fraction; that is, $\frac{3}{4}$ of 84 means $\frac{3}{4} \times 84$. The pupils should understand the meaning of the sign × in this connection. The work on page 87 shows the method of finding a fractional part of a whole number when the work is so easy that it can be done mentally; in such cases, the answer is usually a whole number. Page 89 shows the method of finding a fractional part of a whole number by using paper and pencil. There is a fundamental difference between the work on page 87 and that on page 89. On page 87 we divide first and then multiply, whereas on page 89 we multiply first and then divide.

Workbook Reference: Arithmetic Workshop, Book 6, page 33

Key: **3.** 3; 9; 2; 12; 35. **4.** 3; 9; 2; 22; 21. **5.** 4; 8; 1; 45; 14. **6.** 3; 15; 6; 33; 23. **7.** 6; 18; 5; 14; 30. **8.** 9; 18; 2; 12; 18. **9.** 7; 5; 6; 9; 4. **10.** 8; 24; 4; 40; 6. **11.** 42; 40; 2; 7; 18. **12.** 30; 28; 4; 40; 25.

Page 88

Aim: To review the multiplication of a whole number by a mixed number

Suggestions: The multiplication of a whole number by a mixed number was first taught in the fifth grade. Hence, this work is a review.

Workbook Reference: Arithmetic Workshop, Book 6, pages 34 and 35

Key: **2.** \$6.51. **3.** \$3.22. **4.** \$8.16. **5.** \$4.65. **6.** 76; 287; 589; 928. **7.** 176; 275; 459; 1206. **8.** 539; 296; 485; 767.

Page 89

Aim: To find fractional parts when paper and pencil are needed

Suggestions: The contrast between the examples on this page and the ones on page 87 is clearly discussed in this Guide for page 87. Stress the difference; and if some pupils ask whether the method used on this page could have been used on page 87, the answer is, "Yes, but the method on page 87 is easier to use in mental arithmetic."

Key: **3.** $3\frac{3}{4}$; $4\frac{2}{5}$; $9\frac{5}{8}$; $13\frac{1}{2}$; $3\frac{3}{10}$. **4.** $4\frac{2}{3}$; $12\frac{3}{4}$; $10\frac{2}{5}$; $9\frac{3}{8}$; $5\frac{5}{16}$. **5.** $1\frac{1}{8}$; $3\frac{1}{6}$; $9\frac{3}{8}$; $7\frac{1}{5}$; $7\frac{7}{12}$. **6.** $7\frac{1}{5}$; $2\frac{5}{8}$; $6\frac{2}{5}$; $5\frac{5}{6}$; $4\frac{13}{16}$. **7.** $3\frac{1}{2}$; $10\frac{2}{3}$; $9\frac{3}{4}$; $8\frac{4}{5}$; $9\frac{9}{10}$. **8.** $3\frac{3}{5}$; $3\frac{3}{5}$; $9\frac{1}{2}$; $4\frac{5}{8}$; $1\frac{5}{12}$. **9.** $4\frac{1}{6}$; $3\frac{1}{3}$; $5\frac{1}{4}$; $14\frac{7}{8}$; $7\frac{5}{16}$. **10.** $4\frac{3}{8}$; $14\frac{1}{6}$; $13\frac{1}{3}$; $4\frac{2}{5}$; $9\frac{1}{10}$. **11.** $4\frac{3}{8}$; $3\frac{3}{4}$; $7\frac{1}{8}$; $9\frac{3}{5}$; $4\frac{7}{12}$.

Pages 90–91

Aim: To present problems dealing with a club picnic

Suggestions: Ex. 1 explains the manner in which stores deal with a fraction of a cent. Some pupils may wish to prove this practice by asking a local storekeeper how he handles such a problem. The remaining problems discuss sales slips and how to make them out. This work follows closely the work on pages 45–47, which dealt with a cash book. If your school sells items such as pencils, magazines, and so on, make plans to have your pupils fill in sales slips in connection with real sales.

Key: 3.

SMITH BAKERY

2½ doz. rolls @ 35		88
1½ doz. cupcakes @65		98
	1	86

4. \$3.05 + \$1.86 = \$4.91; \$8.15 − \$4.91 = \$3.24. **5.** $42\frac{1}{4}$; \$1.88; \$3.33; \$4.38. **6.** $64\frac{3}{4}$; \$.54; \$13.73; \$2.63. **7.** $88\frac{2}{3}$; \$4.88; \$3.91; \$6.85. **8.** $26\frac{1}{4}$; \$.42; \$7.19; \$3.38. **9.** $212\frac{2}{3}$; \$1.03; \$7.88; \$2.87.

Pages 92–93

Aim: To review the multiplication of fractions and mixed numbers by whole numbers

Suggestion: This work was fully developed in Grade 5, but if reteaching is necessary, sample examples are given at the top of pages 92 and 93.

Key: Page 92 **2.** $17 \times \frac{3}{4} = 12\frac{3}{4}$ (cups). **3.** (1) $8 \times \frac{2}{3} = 5\frac{1}{3}$ (cups); (2) $5 \times \frac{2}{3} = 3\frac{1}{3}$ (cups). **5.** $2\frac{1}{2}$; $6\frac{3}{4}$; $1\frac{1}{6}$; $4\frac{2}{3}$; $1\frac{1}{2}$; $\frac{2}{3}$. **6.** $3\frac{1}{3}$; $1\frac{2}{3}$; $2\frac{2}{5}$; $7\frac{1}{2}$; $3\frac{3}{4}$; $2\frac{4}{5}$. **7.** $1\frac{3}{5}$; $1\frac{1}{4}$; $2\frac{1}{4}$; $1\frac{3}{5}$; $5\frac{2}{5}$; $5\frac{1}{4}$. **8.** $1\frac{1}{2}$; $2\frac{2}{3}$; $1\frac{1}{2}$; $\frac{5}{8}$; $4\frac{1}{2}$; $1\frac{1}{8}$. **9.** $\frac{5}{6}$; $2\frac{5}{8}$; $3\frac{1}{2}$; $5\frac{1}{4}$; $4\frac{1}{6}$; 4.

Page 93 **3.** $8\frac{3}{4}$ mi. **4.** (1) $2 \times 4 = 8$ (times); (2) $8 \times 1\frac{3}{8}$ mi. = 11 mi. **5.** $2 \times 38\frac{1}{2}$ mi. = 77 mi. **6.** 30; $39\frac{2}{3}$; $25\frac{7}{8}$; $50\frac{1}{4}$; 420. **7.** 26; $18\frac{2}{3}$; $38\frac{1}{2}$; 119; $1210\frac{2}{3}$. **8.** $11\frac{7}{8}$; $20\frac{1}{4}$; $19\frac{3}{8}$; 233; 539. **9.** $18\frac{1}{5}$; $12\frac{2}{3}$; 35; $74\frac{1}{4}$; $362\frac{1}{2}$.

Page 94

Aim: To review and extend measures of length to include rods

Suggestions: The measure *rod* is almost never used in America today. At one time, before the invention of steel or cloth tapes, surveyors carried rods with them to make rough measurements of large tracts of land. Today the 100-foot steel tape is used. Engineers and surveyors rely completely on feet and yard measurements and refer to the rod only when studying some old land title or abstract. All land measurements today are stated in feet, yards, or miles. However, *American Arithmetic, Grade 6* introduces the rod at this time as an appreciation of the way people *used to measure*. An encyclopedia will give further historical background to this measure, which at one time in early England was called *the rood.*

Key: 3. 33 ft.; 99 ft.; $148\frac{1}{2}$ ft. **4.** 22 yd.; 44 yd.; $27\frac{1}{2}$ yd. **5.** 30 × 65¢ = 1950¢ or \$19.50. **6.** (1) 4 × 5280 ft. = 21,120 ft., or the well is more than 4 mi. deep;

(2) 21.465 ft. − 21,120 ft. = 345 ft. **7.** (1) $3 \times 220 = 660$ (ft.); (2) $660 \div 5280 = \frac{1}{8}$ (mi.). **8.** (1) $1320 \div 5280 = \frac{1}{4}$ (mi.); (2) 4 times for 1 mi., or 8 times for 2 mi.

Page 95

Aim: To present the first set of improvement tests in division and a review of measures

Suggestions: A set of three improvement tests in division is given on this page. Before taking each of these tests, the pupils must copy the exercises, spreading them well over the sheet so that ample room is left to work them. The time assigned to each test, which is $3\frac{1}{2}$ min., does not include the time spent in copying. This time is the time actually allowed for taking the test after the examples have been copied. For directions for giving these tests, see the pages of this Guide relating to textbook pages 54–58. Ex. 7–15 deal with fractional parts of measures and make excellent oral testing material.

Key: **1.** 970 R3; 608 R7; 635 R5. **2.** 819; 279; 473. **3.** 462 R5; 256; 418. **4.** 295 R7; 538; 407 R1. **5.** 715 R1; 564; 609. **6.** 963; 540 R6; 871 R2. **7.** 5280; 6; 5. **8.** 4; $\frac{1}{2}$; 1. **9.** 12; $\frac{1}{2}$; $\frac{1}{2}$. **10.** 18; 60; $\frac{3}{4}$. **11.** 4; 14; 8. **12.** 2; 1; 48; **13.** 27; $\frac{3}{4}$; $\frac{1}{2}$. **14.** 2640; 36; $\frac{3}{4}$. **15.** 45; 1; $\frac{1}{4}$.

Pages 96–97

Aim: To reteach the finding of perimeters

Suggestions: Be sure that the pupils understand the words *dimensions* and *perimeter*. Also point out to them that feet and inches can be written as ′ and ″. The problems on page 97 assist pupils in understanding the meaning of a perimeter. Encourage the pupils to draw a picture of each problem before trying to find the perimeter. Have them label each dimension and pretend that they are walking around the perimeter. Use she word *perimeter* in many different situations so that the pupils will become familiar with this mathematical term.

Key: **4.** (1) $4 + 2\frac{1}{2} + 4 + 2\frac{1}{2} = 13$ (ft.); (2) $31 + 17 + 31 + 17 = 96$ (in.). **5.** 56 in. + 76 in. + 56 in. + 76 in. = 264 in. **6.** 264 in. + 6 in. = 270 in.; $270 \div 36 = 7\frac{1}{2}$ (yd.). **7.** (1) 200 ft. + 240 ft. + 200 ft. + 240 ft. = 880 ft.; (2) 6×880 ft. = 5280 ft.; (3) yes. **8.** 18.ft. + $10\frac{1}{2}$ ft. + 18 ft. + $10\frac{1}{2}$ ft. = 57 ft. **9.** (1) Divide by 12; (2) the one in ex. 8; (3) there is less work. **10.** 11 in. + 19 in. + 11 in. + 19 in. = 60 in., or 5 ft. **11.** $7'' + 12'' + 7'' + 12'' = 36''$; $3' + 7\frac{1}{2}' + 3' + 7\frac{1}{2}' = 21'$. **12.** 46 yd.; 78″; 33′. **13.** 34 in.; 114″; 24′. **14.** $20\frac{1}{2}$ ft.; 80″; 32′.

Pages 98–99

Aim: To review basic skills and vocabulary

Suggestions: No new work is found on these pages. The vocabulary completion test on page 99 should be completed by every pupil, but the numerous examples on page 98 need not be finished by everyone. Pupils who already have a mastery of these skills may be excused from doing more than the first line of each type of example.

Key: Page 98 **1.** 4278; 188,272; 420,992; \$607.60. **2.** 9009; 408,947; 361,008; \$3670.44. **3.** 7120; 366,025; 916,500; \$738.92. **4.** 5625; 306,068; 158,004; \$1960.75. **5.** \$168.55. **6.** 18,750 lb. **7.** \$29.94. **8.** \$6.93. **9.** 2122; 2939. **10.** 2756; 2800. **11.** 2270; 2012. **12.** 2202; 2000. **13.** 24,306; 48,598; 37,032; 5870; 19,987. **14.** 51,857; 76,149; 64,583; 33,421; 47,538. **15.** $10\frac{1}{8}$; $1\frac{5}{8}$; $8\frac{1}{3}$; 49. **16.** 12; $9\frac{1}{2}$; 42; $40\frac{1}{2}$. **17.** $12\frac{5}{12}$; $1\frac{7}{12}$; $17\frac{1}{2}$; $14\frac{1}{4}$. **18.** 23; $5\frac{1}{3}$; 39; $44\frac{5}{8}$. **19.** $16\frac{15}{16}$; $5\frac{4}{5}$; $10\frac{1}{2}$; $11\frac{2}{3}$. **20.** $8\frac{1}{20}$; $3\frac{3}{4}$; $25\frac{2}{3}$; $36\frac{4}{5}$.

Page 99 **1.** Addends; sum. **2.** Minuend; subtrahend; remainder, difference. **3.** Millions; billions. **4.** Multiplicand; multiplier; product. **5.** Dividend; divisor; quotient; remainder. **6.** Numerator; denominator; terms. **7.** Proper; improper. **8.** Mixed number. **9.** Least common denominator. **10.** Changed; lowest terms. **11.** Perimeter. **12.** Dimensions.

Pages 100–101

Aim: To teach the multiplication of a fraction by a fraction

Suggestions: The development of the multiplication of a fraction by a fraction is given with extreme care on page 100. This development may serve as a model in presenting the topic to the pupils. In this work we must make clear what is meant by multiplying a fraction by a fraction. The concept is given in ex. 2, where we show that $\frac{1}{3} \times \frac{1}{4}$ means $\frac{1}{3}$ of $\frac{1}{4}$. Again emphasize the fact that the sign × means "of" when written *after* a fraction. Ex. 1 shows objectively what is meant by taking $\frac{1}{3}$ of $\frac{1}{4}$ of a cake. The result is $\frac{1}{12}$. Hence, ex. 1 shows that $\frac{1}{3}$ of $\frac{1}{4}$ equals $\frac{1}{12}$. In similar manner, ex. 3 shows how to find $\frac{1}{2}$ of $\frac{1}{8}$, the result being $\frac{1}{16}$. Thus, $\frac{1}{2} \times \frac{1}{8} = \frac{1}{16}$ becomes meaningful. You can see that any example in the multiplication of a fraction by a fraction can be illustrated by using objects or by drawing diagrams, as in ex. 1 and 3, but such a procedure would be too long and cumbersome to use in practice. Hence, we need a shorter way to obtain the answers. Such a short way is shown in ex. 8. The rule at the bottom of page 101 should be used from this point on.

Workbook Reference: Arithmetic Workshop, Book 6, page 37

Key: **4.** $\frac{1}{8}$; $\frac{1}{6}$; $\frac{1}{24}$; $\frac{1}{15}$; $\frac{1}{16}$. **5.** $\frac{1}{2} \times \frac{1}{2}$ yd. = $\frac{1}{4}$ yd. **7.** $\frac{3}{8}$; $\frac{5}{18}$; $\frac{7}{16}$; $\frac{5}{16}$; $\frac{14}{24}$ or $\frac{7}{12}$. **9.** $\frac{2}{5}$; $\frac{3}{10}$; $\frac{1}{8}$; $\frac{1}{8}$; $\frac{3}{10}$. **10.** $\frac{3}{32}$; $\frac{5}{24}$; $\frac{3}{16}$; $\frac{3}{8}$; $\frac{1}{6}$.

Page 102

Aim: To illustrate ways in which fractions are used

Suggestions: The problems in ex. 1–7 illustrate some ways in which children might use fractions. Each of these problems involves the multiplication of a fraction by a fraction. Beginning with ex. 8, practice exercises are given.

Key: **1.** $\frac{1}{2} \times \frac{1}{2}$ yd. = $\frac{1}{4}$ yd. **2.** $\frac{1}{3} \times \frac{3}{4}$ lb. = $\frac{3}{12}$ lb., or $\frac{1}{4}$ lb. **3.** $\frac{2}{3} \times \frac{3}{4}$ qt. = $\frac{6}{12}$ qt., or $\frac{1}{2}$ qt. (1 pt.). **4.** $\frac{1}{2} \times \frac{2}{3}$ cup = $\frac{2}{6}$ cup, or $\frac{1}{3}$ cup. **5.** $\frac{1}{4} \times \frac{2}{3}$ hr. = $\frac{2}{12}$ hr., or $\frac{1}{6}$ hr.

6. $\frac{1}{2} \times \frac{1}{2}$ bu. = $\frac{1}{4}$ bu. **7.** $\frac{1}{3} \times \frac{1}{8}$ acre = $\frac{1}{24}$ acre. **8.** $\frac{3}{32}$; $\frac{8}{15}$; $\frac{1}{15}$; $\frac{2}{5}$; $\frac{7}{16}$. **9.** $\frac{3}{8}$; $\frac{1}{8}$; $\frac{1}{4}$; $\frac{1}{2}$; $\frac{5}{18}$. **10.** $\frac{1}{12}$; $\frac{3}{20}$; $\frac{1}{4}$; $\frac{5}{12}$; $\frac{1}{6}$. **11.** $\frac{1}{12}$; $\frac{1}{10}$; $\frac{1}{9}$; $\frac{1}{3}$; $\frac{3}{16}$. **12.** $\frac{1}{8}$; $\frac{4}{9}$; $\frac{3}{16}$; $\frac{1}{20}$; $\frac{1}{16}$. **13.** $\frac{1}{16}$; $\frac{2}{5}$; $\frac{1}{6}$; $\frac{2}{3}$; $\frac{5}{16}$. **14.** $\frac{1}{4}$; $\frac{5}{9}$; $\frac{1}{20}$; $\frac{1}{12}$; $\frac{3}{16}$. **15.** $\frac{1}{5}$; $\frac{5}{24}$; $\frac{1}{4}$; $\frac{3}{16}$; $\frac{1}{2}$. **16.** $\frac{2}{9}$; $\frac{1}{30}$; $\frac{1}{9}$; $\frac{9}{16}$; $\frac{1}{5}$.

Pages 103–104

Aim: To present multiplication of a fraction by a fraction in which cancellation is used

Suggestions: Cancellation is explained in ex. 1 on page 103. You should make clear to the pupils that cancellation is merely an application of the principle of fractions, given on page 59 of the text, which states that you can divide both terms of a fraction by the same number and get another fraction having the same value. In an example like the one at the right, point out also that the number *canceled* is 4, which means that 12 and 16 have been divided by 4; 12 and 16 were *not* canceled. The lines drawn through 12 and 16 merely indicate in this case that these numbers have been divided by 4. The fraction $\frac{3}{4}$, which was obtained by canceling, has the same value as $\frac{12}{16}$.

$$\frac{\overset{3}{\cancel{12}}}{\underset{4}{\cancel{16}}} = \frac{3}{4}$$

Some teachers prefer not to use the word *cancel* but to require the pupils to speak always of *dividing* both numerator and denominator by the same number. This practice has much to commend it since it centers the pupil's attention on the fundamental principle that both terms of a fraction may be divided by the same number without changing the value of the fraction. If the word *cancel* is used, make clear that it means *divide* when used in work in fractions.

The use of cancellation in the multiplication of fractions is first explained in ex. 3 on page 103. In this exercise the model example, which is $\frac{2}{3} \times \frac{7}{8}$, is worked in two different ways. In A, the cancellation does not take place until *after* the numerators and denominators have been multiplied together. In B, the cancellation is done *before* the multiplication of the numerators and the denominators takes place. In B, both a numerator and a denominator are divided by the same number. For example, the numerator 2 and the denominator 8 are both divided by 2. This work is an application of the fundamental principle of fractions; namely, that the numerator and the denominator of a fraction may be divided by the same number without changing the value of the fraction. When you cancel in the multiplication of fractions, you merely change the answer to lowest terms *in advance.* This is fully illustrated in B of ex. 3.

B in ex. 3 illustrates another point that requires attention. When the numerator 2 was divided by 2, the number 1 was written above 2. The practice of writing the number 1 in cases like this one will avoid many difficulties that might otherwise arise later on. Ex. 4 on page 103 illustrates the use of cancellation in the example $4 \times \frac{3}{4}$. Notice in the work that 4 is first written as $\frac{4}{1}$ before the multiplication takes place.

In the model example on page 104, double cancellation is explained. In the work it is seen that with certain cancellations the number 1 is written above or below the number.

Workbook Reference: Arithmetic Workshop, Book 6, page 38

Key: Page 103 **2.** $\frac{3}{4}$; $\frac{4}{5}$; $\frac{3}{5}$; $\frac{3}{4}$; $\frac{2}{3}$; $\frac{2}{3}$; $\frac{7}{8}$.

Page 104 **2.** $\frac{1}{3}$ cup. **3.** $\frac{1}{2}$; $\frac{1}{8}$; 2; $\frac{1}{32}$; $\frac{1}{8}$. **4.** $\frac{1}{3}$; $\frac{11}{16}$; $\frac{9}{20}$; $\frac{5}{18}$; $\frac{7}{24}$. **5.** $\frac{5}{8}$; $\frac{1}{4}$; 12; $\frac{1}{16}$; $\frac{1}{6}$. **6.** $\frac{1}{8}$; $\frac{1}{2}$; $\frac{1}{6}$; $\frac{3}{4}$; $\frac{3}{8}$. **7.** $1\frac{1}{2}$; $1\frac{3}{4}$; $\frac{5}{32}$; $\frac{3}{10}$; $\frac{7}{20}$. **8.** $\frac{5}{12}$; $\frac{1}{5}$; 15; $\frac{1}{4}$; $5\frac{1}{2}$. **9.** $\frac{1}{4}$; $\frac{5}{32}$; $\frac{1}{18}$; $1\frac{1}{2}$; $\frac{1}{12}$. **10.** $\frac{1}{2}$; $\frac{7}{16}$; $\frac{1}{4}$; 6; $\frac{1}{2}$. **11.** $\frac{1}{4}$; $\frac{1}{16}$; $\frac{3}{5}$; $\frac{1}{4}$; $\frac{1}{10}$.

Page 105

Aim: To extend the work on pages 103 and 104 to include more difficult cancellation

Suggestions: The exercises on page 103 are of this type: $\frac{2}{3} \times \frac{7}{8}$. In working this example by cancellation, you divide both 2 and 8 by 2. That is, the 2 by which you divide is the *same* as the numerator 2. Likewise, in $\frac{5}{6} \times \frac{3}{16}$, the 3 by which you divide both 3 and 6 is the same as the numerator 3. Cases like these represent the easier type of cancellation. A harder type of cancellation is illustrated in ex. 1 on page 105, where the example is $\frac{6}{1} \times \frac{5}{8}$. In this case you divide both 6 and 8 by 2. That is, the 2 by which you divide *differs* from both 6 and 8. Other examples of this more difficult type of cancellation are shown in ex. 2 on page 105, which should be studied. Notice that each of these examples requires double cancellation.

Workbook Reference: Arithmetic Workshop, Book 6, page 39

Key: **2.** $\frac{3}{8}$; $\frac{4}{9}$. **3.** $1\frac{1}{3}$; $6\frac{3}{4}$; $\frac{4}{25}$; $7\frac{1}{2}$; $\frac{15}{32}$. **4.** $\frac{3}{4}$; $2\frac{2}{5}$; $7\frac{1}{2}$; $3\frac{3}{4}$; $2\frac{4}{9}$. **5.** $7\frac{1}{2}$; $17\frac{1}{2}$; $\frac{3}{8}$; $5\frac{3}{5}$; $\frac{5}{32}$. **6.** $\frac{2}{3}$; $\frac{5}{6}$; $\frac{9}{32}$; $\frac{2}{9}$; $\frac{5}{28}$. **7.** $1\frac{1}{2}$; $\frac{4}{5}$; $\frac{25}{56}$; $4\frac{1}{2}$; $\frac{3}{20}$. **8.** $6\frac{2}{3}$; $7\frac{1}{2}$; $\frac{12}{25}$; $\frac{2}{25}$; $2\frac{4}{5}$. **9.** $4\frac{1}{2}$; $1\frac{7}{8}$; $10\frac{1}{2}$; $5\frac{1}{4}$; $12\frac{1}{2}$.

Page 106

Aim: To present problems containing fractions

Key: **1.** (1) $\frac{3}{4} \times 20 = 15$ (teaspoons); (2) $\frac{3}{4} \times 6 = 4\frac{1}{2}$ (teaspoons). **2.** (1) $\frac{1}{4} \times 20 = 5$ (cups of water), $\frac{3}{4} \times 20 = 15$ (cups of milk); (2) $\frac{1}{4} \times 6 = 1\frac{1}{2}$ (cups of water), $\frac{3}{4} \times 6 = 4\frac{1}{2}$ (cups of milk). **3.** \$2.75 + \$.50 + \$1.75 + \$1.40 + \$.75 = \$7.15; \$.19 + \$.25 + \$2.13 + \$.69 + \$.08 = \$3.34; \$7.15 − \$3.34 = \$3.81. **4.** 2 × 7 days = 14 days; 1500 ÷ 14 = $107\frac{1}{7}$, or about 107 mi. **5.** $4\frac{1}{2}$ × 20 min. = 90 min.; 90 min. before 5:45 P.M. is 4:15 P.M. **6.** $1\frac{3}{4}$ hr. + 2 hr. + $2\frac{1}{4}$ hr. + $1\frac{1}{2}$ hr. + $2\frac{1}{2}$ hr. + $5\frac{1}{4}$ hr. = $15\frac{1}{4}$ hr.; $15\frac{1}{4}$ × 60¢ = 915¢ or \$9.15. **7.** 5 × \$.07 = \$.35, $\frac{1}{2}$ × \$.80 = \$.40, \$.35 + \$.40 + \$.45 = \$1.20. **8.** 35 × \$69.85 = \$2444.75. **9.** From 4:50 to 5:04 is 14 min.; 14 min. + 17 min. = 31 min. **10.** $2\frac{1}{2}$ × \$.95 = \$$2.37\frac{1}{2}$ or \$2.38; \$2.38 + \$.55 + \$.30 = \$3.23; \$3.23 + \$.19 = \$3.42. **11.** \$17.60 ÷ 32 = \$.55.

Page 107

Aims: To give the second set of improvement tests in addition and to review arithmetical terms

Suggestions: This new set of improvement tests in addition is to be given in the same manner as the first set of such tests.

Success in arithmetic depends upon understanding the language of arithmetic. Hence, the pupils should show that they understand the meaning of such words as those given in ex. 4–21.

Key: **1.** 2046; 2986; 2902; 2581; 2777; 2743. **2.** 3051; 2110; 3102; 3349; 2801; 2205. **3.** 2337; 1900; 3054; 2647; 2921; 2345.

Page 108

Aim: To prepare for multiplication of mixed numbers by reviewing how to change a mixed number to an improper fraction

Key: **2.** 7; 51; 14; 23; 53. **3.** 21; 17; 71; 37; 67. **4.** 7; 15; 43; 37; 25. **5.** 5; 17; 17; 28; 99. **6.** $\frac{9}{2}$; $\frac{49}{6}$; $\frac{52}{5}$; $\frac{18}{7}$; $\frac{73}{8}$; $\frac{24}{5}$; $\frac{20}{3}$; $\frac{41}{10}$. **7.** $\frac{33}{4}$; $\frac{27}{8}$; $\frac{37}{3}$; $\frac{55}{6}$; $\frac{27}{4}$; $\frac{31}{8}$; $\frac{23}{4}$; $\frac{35}{12}$. **8.** $\frac{13}{5}$; $\frac{15}{8}$; $\frac{89}{8}$; $\frac{16}{5}$; $\frac{29}{6}$; $\frac{29}{3}$; $\frac{15}{2}$; $\frac{19}{16}$. **9.** $\frac{22}{7}$; $\frac{36}{5}$; $\frac{61}{4}$; $\frac{13}{8}$; $\frac{29}{5}$; $\frac{32}{5}$; $\frac{65}{8}$; $\frac{85}{12}$.

Pages 109–110

Aim: To teach the multiplication of mixed numbers by fractions or mixed numbers

Suggestions: A careful study of the model examples in ex. 1 and 2 on page 109 will show that each mixed number is to be changed to an improper fraction before the multiplication takes place. Ex. 3 on page 109 also deserves careful study. This exercise illustrates the trouble that the pupil may encounter if he does not write the 1's when he cancels. In the exercises on page 110, remind the pupils to change each mixed number to an improper fraction before multiplying.

Workbook Reference: Arithmetic Workshop, Book 6, page 42

Key: Page 110 **1.** $\frac{1}{2} \times 1\frac{1}{2}$ hr. = $\frac{3}{4}$ hr. **2.** $\frac{1}{2} \times 13\frac{1}{2}$ mi. = $6\frac{3}{4}$ mi. **3.** $\frac{1}{2} \times 2\frac{1}{2}$ cups = $1\frac{1}{4}$ cups. **4.** $1\frac{1}{2} \times 2\frac{1}{2}$ cups = $3\frac{3}{4}$ cups. **5.** $1\frac{3}{4}$; $6\frac{1}{4}$; $\frac{1}{5}$; $3\frac{3}{4}$. **6.** $2\frac{3}{16}$; $\frac{1}{2}$; $1\frac{4}{5}$; $2\frac{2}{5}$. **7.** 5; $\frac{3}{4}$; 2; $\frac{1}{2}$. **8.** $\frac{3}{8}$; $8\frac{3}{4}$; $\frac{1}{2}$; $\frac{3}{4}$. **9.** 1; $\frac{1}{4}$; $\frac{1}{5}$; 10. **10.** 1; 12; $\frac{4}{9}$; 2. **11.** 4; $1\frac{3}{4}$; $1\frac{9}{16}$; $\frac{2}{5}$. **12.** $\frac{7}{8}$; $16\frac{1}{2}$; 1; 3. **13.** $1\frac{2}{5}$; $3\frac{3}{4}$; $\frac{15}{32}$; 10.

Page 111

Aim: To reteach a method for finding areas

Suggestions: A way of finding the area of a rectangle and a square was taught in *American Arithmetic, Grade 5.* Before taking up page 111, which reteaches the method, you might try the following:

1. Explain that area is measured differently from straight lines. In measuring straight lines, a ruler is used, whereas in measuring area, a square inch or a square foot is used.
2. Have a pupil draw a square inch and a square foot on the blackboard.
3. Have each pupil make a square inch out of cardboard.
4. Give each pupil a piece of paper which is 6 inches by 9 inches (regular arithmetic paper), and ask each one to use his square inch to count the number of square inches on the paper.
5. After the pupils have counted and found that there are 54 square inches, have them use a ruler to draw the 54 square inches on the paper. Have them number the squares as shown at the top of page 47.

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54

6. This rectangle has 6 rows with 9 square inches in each row.
7. Therefore, 6 × 9 square inches = 54 square inches.
8. Thus, if the length and the width of a rectangle are known, the area can be determined.

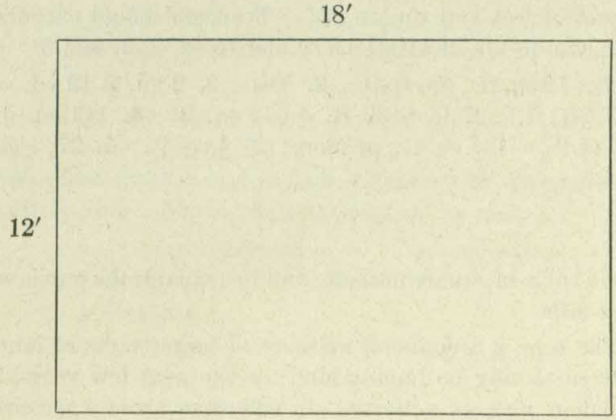
Follow the same procedure for finding the area of a square. Be sure the pupils realize that a square is a special kind of rectangle (a square is a rectangle which has width equal to length). Provide graph paper and allow pupils to draw other rectangles and prove again the rule they discover for finding area (steps 6 and 7 above). Do the same for all examples on page 111.

Workbook Reference: Arithmetic Workshop, Book 6, page 46

Page 112

Aim: To reteach the computation of the area of a rectangle and a square without drawing square measure

Suggestions: The work on this page is the abstract phase of the work on page 111. However, pupils should be encouraged to sketch pictures of the areas to be determined; and in problem 1, they would sketch:



Problem 4 reminds pupils that dimensions must be expressed in like units of measure. If pupils find difficulty in understanding the reasoning involved, recall the manner in which area was determined on page 111 (see above); then ask whether it would have been possible to measure the length of the rectangle in inches and the width in feet, and if so, what the unit of square measure would have been. Pupils need to talk out inconsistencies rather than being told that "you cannot measure area unless both dimensions are in the same units."

Ex. 6–9 provide many examples in which one of the measures must be changed to a mixed number before computation can take place. Some pupils may suggest that problem 4 could have been changed to inches, and that if 140 inches were multiplied by 144 inches the answer would have been in square inches. Tell the children that this method of solving the problem is correct, but indicate that the answer in square inches would then probably be changed back to square feet, thus forcing another computation.

Key: **1.** 216 sq. ft. **2.** (1) 12 ÷ 3 = 4 (yd.); (2) 18 ÷ 3 = 6 (yd.); (3) 24 sq. yd. **3.** 96 sq. ft. **4.** 140 sq. ft. **5.** 9 ft. = 3 yd., 15 ft. = 5 yd., 3 × 5 = 15 (sq. yd.). **6.** (1) 99 sq. in.; (2) $4\frac{1}{2}$ ft. × 18 ft. = 81 sq. ft.; (3) $7\frac{2}{3}$ yd. × 12 yd. = 92 sq. yd. **7.** (1) 3 ft. × 4 ft. = 12 sq. ft.; (2) $5\frac{3}{4}$ ft. × 16 ft. = 92 sq. ft.; (3) $4\frac{1}{3}$ yd. × 18 yd. = 78 sq. yd. **8.** (1) 5 yd. × 6 yd. = 30 sq. yd.; (2) $9\frac{1}{3}$ ft. × 15 ft. = 140 sq. ft.; (3) $2\frac{1}{3}$ yd. × 15 yd. = 35 sq. yd. **9.** (1) 540 sq. ft.; (2) $6\frac{1}{4}$ ft. × 20 ft. = 125 sq. ft.; (3) $9\frac{2}{3}$ yd. × 18 yd. = 174 sq. yd.

Page 113

Aim: To provide readiness for understanding the table of square measure

Suggestions: Ex. 1 provides a way for pupils to discover the number of square feet in a square yard. Ex. 4 does the same for the number of square inches in a square foot. More able pupils will wish to extend this idea to the number of square inches in a square yard. Ex. 2 shows pupils how to convert square feet to square yards. This type of conversion is rather common in everyday life, since many types of articles are sold by the square yard although the buyer finds it easier to measure in terms of feet and square feet. Teachers should encourage pupils to make up other true-to-life illustrations similar to ex. 2, 3, and 5.

Key: **1.** 9 sq. ft.; 72 sq. ft.; 45 sq. ft. **2.** Yes. **3.** 9 yd. × 12 yd. = 108 sq. yd., 9 × 108 = 972 (sq. ft.); 27 ft. × 36 ft. = 972 sq. ft. **4.** 144 sq. in.; 72 sq. in. **5.** (1) 3 ft. × $4\frac{1}{2}$ ft. = $13\frac{1}{2}$ sq. ft., or more; (2) $\frac{1}{2}$ sq. ft. **6.** 27; 1584. **7.** 54; 2. **8.** 432; 5.

Page 114

Aims: To show a table of square measure and to acquaint the pupils with the terms *acre* and *square mile*

Suggestions: The *acre* is a common measure of large tracts of land. Although pupils will not personally be buying land for the next few years, their parents may be engaged in such an activity. In suburban areas a person who buys a house boasts of the fact that he has a $\frac{1}{2}$ acre of land with the house, whereas another man says that his house is on a lot 100 ft. × 200 ft. In reality, the two families live on about the same amount of land, but the $\frac{1}{2}$ acre sounds much larger. Ex. 3 helps children understand what an acre really is.

The term *square mile* is important to an understanding of the geography of our country. In *The World Almanac* the areas of states are given in square miles.

The table presented on this page should NOT be memorized. Rather, it should be understood. Pupils can readily learn how to find the number of square inches in a square foot, the number of square feet in a square yard, and even the number of square feet or square yards in a square mile. They can also recall easily that an acre is about 200 feet square. Exact recollection of the number of square feet in an acre is not necessary, and the drudgery connected with the memorization of the table of square measure cannot be sugar-coated by the promise that the child will need to know this table. It is much better to teach the WHY of this table than to expect a blind repetition of the numbers involved.

Workbook Reference: Arithmetic Workshop, Book 6, page 47

Key: **1.** (1) 43,681 sq. ft.; (2) yes; (3) a little more. **2.** (1) 43,264 sq. ft.; (2) less; (3) 43,681 sq. ft. is 121 sq. ft. larger than an acre, and 43,264 sq. ft. is 296 sq. ft. smaller than an acre; so the area of a square 209 ft. on each side is closer. **6.** 150 ft. × 600 ft. = 90,000 sq. ft., or about 2 acres. **7.** $12\frac{1}{2} \times \$200 = \$2500$. **8.** 180 ft. × 121 ft. = 21,780 sq. ft.; $\frac{21,780}{43,560}$ sq. ft. = $\frac{1}{2}$ acre.

Page 115

Aim: To use the table of square measure in solving problems

Key: **1.** 5280 ft. ÷ 330 ft. = 16 (times). **2.** (1) Since the room is 18 ft. wide, Mrs. Jackson will have to buy 2 strips of carpet 9 ft. wide and 25 ft. long, or 50 running feet; (2) 50 × \$7.95 = \$397.50. **3.** (1) 9 ft. + 12 ft. + 9 ft. + 12 ft. + 1 ft. = 43 ft.; (2) 50 ft. − 43 ft. = 7 ft. **4.** 6 × 5280 ft. = 31,680 ft., 7 × 5280 ft. = 36,960 ft.; so the spot is nearer 7 mi. deep. **5.** 16 ft. × 20 ft. = 320 sq. ft., 2 × 320 sq. ft. = 640 sq. ft.; yes. **6.** 5 ft. × 135 ft. = 675 sq. ft.; 675 ÷ 9 = 75 (sq. yd.). **7.** 2880; $\frac{1}{4}$. **8.** 3; 90. **9.** 1584; 9.

Page 116

Aim: To review the major aims of Chapter 3

Suggestion: This chapter test reviews all eleven of the major aims of Chapter 3 as set forth in this Guide at the beginning of the chapter.

Chapter Review	*Aim Number*
Ex. 1	5
Ex. 2	4
Ex. 3	2, 3, 6, 7
Ex. 4 and 5	9
Ex. 6 and 7	10
Ex. 8, 10, 12, 13	1
Ex. 9	8
Ex. 11	11
Ex. 14 and 15	2 and 3

Key: **1.** $\frac{7}{4}$; $\frac{15}{2}$; $\frac{23}{8}$; $\frac{14}{3}$; $\frac{79}{12}$; $\frac{25}{16}$; $\frac{53}{10}$. **2.** $\frac{4}{5}$; $\frac{2}{9}$; $\frac{3}{4}$; $\frac{1}{3}$; $\frac{2}{9}$; $\frac{2}{7}$; $\frac{5}{9}$; $\frac{3}{8}$. **3.** 54; 12; $\frac{9}{20}$; $61\frac{1}{4}$. **4.** (1) 34 ft., 72 sq. ft.; (2) 23 ft., 30 sq. ft.; (3) 98″, 570 sq. in. **5.** (1) 40 ft., 36 sq. ft.; (2) $28\frac{2}{3}$ ft., 50 sq. ft.; (3) 364′, 1392 sq. ft. **6.** Multiply by 144. **7.** Divide by 9. **8.** 24 ft.; 27 ft.; 45 ft. **9.** 66 ft.; $115\frac{1}{2}$ ft. **10.** 2 × 5280 ft. = 10,560 ft., 10,560 ft. − 10,125 ft. = 435 ft.; so 10,125 ft. is 435 ft. less than 2 mi. **11.** 600 ft. × 145 ft. = 87,000 sq. ft., 2 × 43,560 sq. ft. = 87,120 sq. ft., so the area is 120 sq. ft. less than 2 acres. **12.** 48 × $\frac{1}{2}$ pt. = 24 pt., 24 ÷ 8 = 3 (gal.). **13.** (1) 8 oz. = $\frac{1}{2}$ lb., $\frac{1}{2}$ × \$1.20 = \$.60; (2) 10 oz. = $\frac{5}{8}$ lb., $\frac{5}{8}$ × \$1.20 = \$.75. **14.** $4\frac{1}{2}$ × $1\frac{1}{3}$¢ = 6¢. **15.** (1) 2 × $\frac{3}{8}$¢ = $\frac{3}{4}$¢; (2) 4 × $\frac{3}{8}$¢ = $1\frac{1}{2}$¢.

Page 117

Aim: To present Problem Test 3

Suggestion: Remind the pupils to record the scores on the bar graphs which they began at the beginning of the school year.

Workbook Reference: Arithmetic Workshop, Book 6, page 49

Key: **1.** (1) 2 × $\frac{1}{4}$ mi. = $\frac{2}{4}$ mi., or $\frac{1}{2}$ mi.; (2) 4 × $\frac{1}{4}$ mi. = 1 mi. **2.** $12\frac{1}{2}$ ft. × 18 ft. = 225 sq. ft. **3.** $2\frac{1}{2}$ hr. + $5\frac{3}{4}$ hr. = $8\frac{1}{4}$ hr.; $8\frac{1}{4}$ × 60¢ = 495¢, or \$4.95. **4.** 13 × 5280 ft. = 68,640 ft., 14 × 5280 ft. = 73,920 ft., so 14 mi. is nearer. **5.** $9\frac{1}{2}$ × $16\frac{1}{2}$ ft. = $156\frac{3}{4}$ ft. **6.** $\frac{1}{2}$ × $2\frac{3}{4}$ lb. = $1\frac{3}{8}$ lb. **7.** 6 ft. + 21 ft. + 6 ft. + 21 ft. + 1 ft. = 55 ft. **8.** 6 ft. × 144 ft. = 864 sq. ft., 864 ÷ 9 = 96 (sq. yd.), 96 × \$3.75 = \$360.00. **9.** $1\frac{1}{2}$ × \$.79 = \$1.18$\frac{1}{2}$, or \$1.19, \$1.19 + \$.65 = \$1.84, \$5.00 − \$1.84 = \$3.16. **10.** $1\frac{1}{2}$ × $\frac{3}{4}$ cup = $1\frac{1}{8}$ cups.

Page 118

Aim: To present a diagnostic test with page references for remedial work

Key: **1.** $6\frac{7}{8}$; $11\frac{3}{5}$; $7\frac{5}{6}$; $14\frac{1}{12}$; $13\frac{17}{24}$. **2.** $3\frac{5}{8}$; $1\frac{1}{2}$; $1\frac{5}{6}$; $\frac{5}{12}$; $5\frac{19}{20}$. **3.** $\frac{15}{4}$; $\frac{15}{2}$; $\frac{43}{8}$; $\frac{23}{6}$; $\frac{29}{12}$. **4.** 12; 30; 24. **5.** $7\frac{1}{2}$; $11\frac{1}{4}$; $9\frac{1}{6}$. **6.** 28; $66\frac{1}{2}$; \$2.92$\frac{1}{2}$ or \$2.93. **7.** $7\frac{1}{5}$; $6\frac{2}{3}$; 6. **8.** 38; $11\frac{1}{4}$; $38\frac{2}{3}$. **9.** $\frac{1}{6}$; $\frac{9}{20}$; $\frac{3}{16}$. **10.** 7; $\frac{3}{5}$; $\frac{1}{4}$. **11.** $\frac{3}{4}$; $3\frac{3}{4}$; $5\frac{1}{4}$. **12.** $1\frac{1}{2}$; 1; $2\frac{1}{12}$. **13.** $2\frac{1}{2}$; 1; 5. **14.** 8; $1\frac{1}{2}$; $3\frac{3}{4}$.

Chapter 4

Aims of Chapter 4. The major aims of Chapter 4 are to:

1. Review the understandings and skills taught in previous chapters.
2. Reteach the meaning of the decimal fractions tenths, hundredths, and thousandths.
3. Illustrate various ways in which decimal fractions are used in daily living.
4. Show the close relationship which exists between common fractions and decimal fractions.
5. Reteach addition and subtraction of like decimal fractions.
6. Teach the addition and subtraction of ragged decimals.
7. Teach multiplication of decimal fractions by whole numbers.
8. Teach multiplication of decimal fractions by decimal fractions.
9. Extend the multiplication of whole numbers to 3-figure multipliers with zeros in the multipliers.
10. Extend treatment of bar graphs.
11. Teach the meaning of the nautical measures *knot* and *sea mile.*

Increasing Importance of Decimals. Decimals are much more frequently used today in industry, business, and everyday life than they were thirty-five years ago. Hence, decimals deserve far more attention today. As the decimal fraction has increased in use, the common fraction has decreased in importance. One frequent use of decimals is in connection with measurements. Today measurements are often made in terms of units that are divided decimally rather than into halves, fourths, and eighths, as was formerly the case. For example, the mile is now frequently divided into *tenths;* hence, distances are measured to tenths of a mile; this use is seen on the speedometer of a car. The practice is found also on timetables and in automobile route books, where distances between places are given to *tenths* of a mile. In time measurements, the second is divided into *tenths* on stop watches, and in modern industry the hour is often divided into *hundredths.* In industry, the inch is divided into *tenths, hundredths, thousandths,* and even *millionths.* In surveying, the foot is divided into *tenths* and *hundredths;* on dairy scales and school scales the pound is divided into *tenths.* Since many of our measurements are now being divided decimally, computations with these measurements are made with decimals rather than with common fractions.

This rapid growth in the use of decimals has been accompanied by a gradually decreasing use of common fractions. Thirty-five years ago common fractions with large denominators were met very frequently, while today most of our common fractions have small denominators. Therefore the instruction in common fractions as it is given in our schools today is much less elaborate than it used to be.

Problems in Teaching Decimals. The topic of decimals is a difficult one for some children because there are relatively few opportunities to give children *experience* in measuring decimally. Aside from the use of decimals in connection with our money system, most of our decimals arise as a result of measurements made with instruments in which the units of measure are divided decimally. While such instruments are widely used in factories and in scientific laboratories, only decimal rulers are available for use in the schoolroom. Hence, there is little opportunity in school to give children experience in making measurements that give decimal results. Decimal measurements cannot be made with the ordinary foot ruler, since such a ruler has the foot divided into 12 parts. While machine shops have instruments for measuring to *hundredths* and *thousandths* of an inch, these instruments are not suitable for use in the schoolroom. The inch on the ordinary ruler is divided into sixteenths rather than into tenths.

In spite of the limited opportunities for actually making decimal measurements, you should take every opportunity to make decimals as real as possible to the pupils. If the school scale used for weighing children has the pound divided into tenths, it can be used as an excellent illustration of the use of decimals. Children who live in the country are acquainted with dairy scales which have the pound divided into tenths. The speedometer of an automobile and the cyclometer of a bicycle afford opportunities to acquaint pupils with miles divided into tenths, while the ordinary clinical thermometer has the degrees divided into tenths. Possibly some children can bring to school a stop watch which has the second divided into tenths. The gasoline pump at the filling station records gallons of gasoline in tenths, and prices in dollars and cents; this use is second only to the great use of decimals in our money system. These objects afford numerous opportunities for using the four fundamental operations with decimals.

Page 119

Aim: To present a project on raising turkeys

Suggestion: Similar projects may be developed in class if some of the pupils are interested in 4–H Club activities.

Key: **1.** 30 × \$.75 = \$22.50. **2.** \$51.75 + \$48.40 + \$22.50 = \$122.65. **3.** \$151.25 − \$122.65 = \$28.60. **4.** (1) \$22.50 + \$52.00 = \$74.50; (2) \$150.00 − \$74.50 = \$75.50. **5.** Peter will make so much more money next year because he will not have to pay for the other supplies.

Page 120

Aim: To extend the understanding of decimal fractions through the thousandths place

Suggestions: Ex. 4 clearly develops the close relationships which exist between common and decimal fractions. Many pupils develop the erroneous idea that decimals are something different and quite apart from common fractions. As this chapter unfolds, be sure to continue to use the term *decimal fraction* whenever a decimal is used. The addition of the word *fraction* will help pupils connect the two ideas.

Decimal fractions were proposed in the late sixteenth century by a Belgian named Simon Stevin. He felt that the continued use of the common fraction with its many denominators, the need for finding lowest common denominators, the changing of mixed numbers to improper fractions, inversion, cancellation, and the like were extremely cumbersome and antiquated. Thus, he proposed fractions with denominators of ten, hundred, thousand, and so on, all of which were to be part of our number system. Also, he argued that if we, in writing whole numbers, understood that the second place was the tens place, the third place the hundreds place, a similar system of understanding (without writing down) could be adopted for writing the fractional part of the number. Thus, the first place to the right of the decimal point was called the *tenths* place, the second place the hundredths place, the third place the thousandths place, and so on; then the decimal point (or period) could be the dividing line between the whole part of the number and the fractional part. The fractional part would always be read as a proper fraction.

Ex. 1 and 2 illustrate the most common use of tenths — measuring mileage. Automobile speedometers record miles in tenths, and railroad timetables show miles in tenths. Road maps usually do not measure mileage closer than the even mile. Ex. 8 again stresses the relationship between the common and the decimal fraction.

Key: **1.** 134.7 mi. **2.** Betty. **8.** .3; .29; .416; .09; 7.8; .027; 3.19.

Page 121

Aim: To extend the practice of reading decimal fractions and mixed decimals through thousandths

Suggestions: Ex. 3 on this page deserves special attention since it shows how to read decimals properly. The method of reading a decimal as given in ex. 4 is also important since it is very much used in business and in science.

Key: **6.** Six tenths, point-six; thirty-five hundredths, point-three-five; two hundred ninety-three thousandths, point-two-nine-three; nine hundredths, point-o-nine; thirty-seven thousandths, point-o-three-seven; seven thousandths, point-o-o-seven; twenty-five and four hundredths, two-five-point-o-four; four and thirty-three thousandths, four-point-o-three-three. **7.** Two tenths, point-two; eight tenths, o-point-eight; sixty-one hundredths, o-point-six-one; thirteen hundredths, point-one-three; one hundredth, o-point-o-one; ten hundredths, o-point-one-o; four and three hundred twenty-eight thousandths, four-point-three-two-eight; seven and five thousandths, seven-point-o-o-five. **8.** Nine tenths, point-nine; three tenths, o-point-three; thirty-nine hundredths, o-point-three-nine; four hundredths, point-o-four; five hundredths, o-point-o-five; seventeen hundredths, o-point-one-seven; six and forty-three thousandths, six-point-o-four-three; nine and nineteen thousandths, nine-point-o-one-nine. **9.** $\frac{6}{10}$, $\frac{35}{100}$, $\frac{293}{1000}$, $\frac{9}{100}$, $\frac{37}{1000}$, $\frac{7}{1000}$, $25\frac{4}{100}$, $4\frac{33}{1000}$; $\frac{2}{10}$, $\frac{8}{10}$, $\frac{61}{100}$, $\frac{13}{100}$, $\frac{1}{100}$, $\frac{10}{100}$, $4\frac{328}{1000}$, $7\frac{5}{1000}$; $\frac{9}{10}$, $\frac{3}{10}$, $\frac{39}{100}$, $\frac{4}{100}$, $\frac{5}{100}$, $\frac{17}{100}$, $6\frac{43}{1000}$, $9\frac{19}{1000}$.

Page 122

Aim: To extend the discussion of the relationship which exists between common and decimal fractions

Suggestions: Some pupils might enjoy reporting on outside reading assignments about the common fraction. The history of the common fraction is most interesting and extends from the sexagesimal fraction (fractions with a denominator of 60) of the Babylonians to the unit fractions of the Egyptians (fractions with a numerator of 1) to the common or vulgar fraction. Mathematicians in the fourteenth and fifteenth centuries had taken the discussion of vulgar fraction to most complicated lengths. Illustrations of these are found in some encyclopedias and histories of mathematics. Such research projects would help pupils realize the importance of the invention of the decimal fraction. As one fully appreciates the contribution which the decimal fraction made to mathematics, his desire to learn more about these new fractions increases. Point out in ex. 6 how clumsy it is to write \$6.34 as $\$6\frac{34}{100}$.

Workbook Reference: Arithmetic Workshop, Book 6, page 50

Key: **1.** 100 small squares; .10; .25; .09; .01; .55. **2.** Ten rows; .1. **3.** 100 small squares; 10 small squares; .10. **8.** Two and nine tenths feet; four and fifty-eight hundredths inches; two hundredths second; sixty-nine and eight tenths miles; fifteen and seventeen thousandths inches. **9.** Seventy-eight hundredths pound; twelve and seven tenths hours; nine and six tenths gallons; fifty-nine thousandths inch; eight thousand thirteen and two tenths miles. **10.** Seven tenths mile; one hundred twenty-five thousandths pound; eighteen hundredths second; seventy-five hundredths pound; ten and eight hundred seventy-five thousandths inches.

Page 123

Aim: To discuss place value in our system of writing numbers

Suggestions: Our system of writing numbers uses the Hindu-Arabic numerals, which are called the Arabic numerals. The important feature of our system lies in the fact that it has *place value*, which means that the value of each figure depends upon the place it occupies. Our system contains the figure 0, which we call *zero*. This 0 gives our system its flexibility. By contrast, the Roman system of writing numbers has no 0 and has no place value. The advantages of our system over the Roman system become more apparent when we compare the two systems, as is done in ex. 6.

Key: **3.** Tens; thousands; hundreds; ones; tenths. **4.** Hundreds; tenths; hundredths; thousands; ones. **6.** No; no; no.

Pages 124–125

Aim: To show a practical use of the addition of decimals

Suggestions: The Weather Bureau measures snowfall to tenths of an inch and rainfall to hundredths of an inch. In many city newspapers the daily weather report tells the number of inches of snow or rain that fell the day before in the larger cities of the United States. In these reports the amount of snowfall is given in tenths of an inch, while the amount of rainfall is given in hundredths of an inch. Pupils might be interested in bringing to class newspapers showing these detailed weather reports.

Key: 2. A little longer. **3.** 2.7 in. + 3.2 in. = 5.9 in. **5.** 25.8 in. − 4.9 in. = 20.9 in. **6.** 55.1 in. − 42.3 in. = 12.8 in.

Page 126

Aim: To test understandings in decimal fractions

Suggestions: Arithmetic must make sense! On this page none of these statements make sense as they now stand. Decimal points have been left out, and thus rather foolish statements appear. The intelligence shown by pupils in correcting these statements will lead the teacher to realize the extent to which discriminate thinking is taking place. Naturally, some statements could have more than one answer. For instance, in ex. 3 the answer might be 1.25 hours or 12.5 hours, but the latter would probably be more correct.

Key: 1. $10.00. **2.** $.45. **3.** 12.5 hr. **4.** $.99. **5.** $.85. **6.** 455 mi. **7.** $12.50. **8.** 9 mi. **9.** $.97. **10.** 3.5 ft.; 5.0 ft. **11.** 165 ft. **12.** 2.2 ft. **13.** 125 lb. **14.** 35.5 mi. **15.** 713 mi. **16.** 10.5 ft.

Page 127

Aim: To present the second set of improvement tests in the subtraction of whole numbers

Suggestion: This set of improvement tests in subtraction is to be given in the same manner as described for the tests in addition.

Key: 1. $20.52; $2.56; $31.68; $14.96; $55.77. **2.** $3.51; $46.68; $44.40; $7.35; $3.39. **3.** $32.84; $19.84; $69.87; $19.79; $24.83. **4.** $40.98; $89.87; $2.68; $36.50; $16.47. **5.** $50.16; $7.55; $14.89; $56.10; $9.82. **6.** $59.68; $25.21; $48.56; $39.73; $28.69. **7.** $12.34; $77.35; $2.26; $43.25; $14.99. **8.** $14.84; $4.56; $29.89; $40.77; $29.79. **9.** $9.88; $33.30; $66.57; $45.86; $19.46.

Page 128

Aim: To show how to add decimals with like names

Suggestions: The placement of the decimal point in the sum is easily explained by referring to examples dealing with dollars and cents. This type of addition of decimals has been practiced since Grade 3. No pupil will question the placement of the decimal point in such work. Now refer to dollars and cents in terms of adding hundredths, and the transition is easily made. If further illustration is needed, talk in terms of an automobile speedometer and the addition of mileage expressed in tenths; naturally there would be tenths also in the sum. The extension to thousandths is then made. Another way of explaining the placement of the decimal point is to draw a line down through all the decimal points and explain that the digits to the left of the decimal point represent *whole numbers,* whereas the digits to the right represent fractions. Keeping the decimal point in a straight line *protects* place value and assures the computer of adding like quantities: ones to ones, tens to tens, tenths to tenths, and so on. The general rule is then apparent — decimal points must be kept in column form in addition (and subtraction).

Workbook Reference: Arithmetic Workshop, Book 6, page 52

Key: 2. 19.93 inches. **3.** 61.65 inches. **4.** 4.36; 44.9; 13.66; 51.5; 6.392; 12.204. **5.** 7.72; 57.5; 19.63; 22.48; 17.899; 12.416. **6.** 311.2; 33.87; 23.99; 21.23; 11.943; 20.035.

Page 129

Aim: To present the addition of decimals of not more than three decimal places, including decimals with different names

Suggestions: In adding decimals, the pupils should write the numbers so that the decimal points are in a line under one another. Ex. 1 on page 129 should have special attention since it shows how to add what are sometimes called "ragged" decimals. The way to write ragged decimals is shown in Column B of ex. 1. Point out that an exercise in the addition of ragged decimals rarely occurs in practical life. Most of the decimals that have to be added have the same number of decimal places, as shown on page 128. Examples in the addition of ragged decimals sometimes occur in civil service and other such examinations; hence, it is desirable to know how to do such examples. In ex. 2–12 on page 129, caution the pupils to write the numbers in columns so that the decimal points will fall in a straight line under one another. The numbers to be added include whole numbers as well as decimals, but the whole numbers are not written with decimal points. In cases like this, it should be *understood* that a decimal point should be written to the right of each whole number. In adding whole numbers and decimals, the pupils should first write a decimal point after each whole number and annex zeros as necessary. For example, in ex. 3 they should write the whole numbers 7 and 4 as 7.000 and 4.000 when the numbers are arranged in columns.

Workbook Reference: Arithmetic Workshop, Book 6, page 53

Key: 2. $18.84. **3.** 23.01. **4.** 40.62. **5.** 96.8. **6.** 65.650. **7.** 46.250. **8.** 48.878, **9.** 32.716. **10.** 72.775. **11.** 35.333. **12.** 45.958.

Page 130

Aim: To teach the subtraction of like decimal fractions through thousandths place

Suggestions: Problems 1 and 2 refer to an automobile speedometer, whereas problem 3 uses dollars and cents. A discussion similar to that outlined in this Guide for page 128 will assist pupils in understanding the placement of the decimal point in the difference.

Key: 2. 4.8 mi. **3.** $4.60. **4.** 19.1; 3.8; 2.092; 3.625; $1884.77. **5.** 5.6; 34.6; 2.276; 3.375; $4427.57. **6.** 36.5; .87; 3.666; 4.899; $710.94. **7.** 3.97; .38; 2.125; 51.09; $2029.86. **8.** .55; 18.2; 44.12; 57.89; $360.26.

Page 131

Aim: To teach subtraction of ragged decimal fractions

Suggestion: The most common use of this skill is in subtracting cents from even dollars. If pupils grasp the ideas set forth in ex. 1, no difficulty should be experienced in completing the work on this page.

Workbook Reference: Arithmetic Workshop, Book 6, page 54

Key: **1.** \$2.35. **2.** \$22.18. **3.** \$106.53. **4.** 85.3; 6.07; 12.52; 386.36; 3371.48. **5.** 4.9; 1.38; \$179.50. **6.** 8.6; 2.63; \$124.61. **7.** 53.5; 5.96; \$145.74. **8.** 2.125; 64.05; \$140.75. **9.** 12.86; 79.33; \$88.60. **10.** 45.57; 2.85; \$245.13. **11.** 1.645; 29.79; \$627.64. **12.** 357.3; .083; \$378.31. **13.** 2.375; 1.90; \$179.83. **14.** 9.83; 25.14; \$189.25.

Page 132

Aim: To illustrate some uses of decimal fractions in everyday life

Suggestions: Weight, rainfall, and distance are illustrated on this page. Although scales graduated to tenths of a pound are still infrequent, there is a trend in this country to graduate all scales to tenths. Such an arrangement would do away with the pound divided into sixteenths and would permit an easy calculation of weights by means of decimal fractions. Large industries are now using such scales. Bakeries weigh large quantities of ingredients, and paint companies weigh mixtures. Ex. 2 refers to the measurement of rainfall and could well lead to an activity of watching the newspaper for one week to read the statistics in the weather column. Not only would some interesting geography learning result, but some pupils might become interested in the matter of weather variations and forecasting. Ex. 5 shows a railroad timetable with mileage expressed in tenths of a mile. The local railroad agent will provide your classroom with a timetable from which many interesting class activities could arise: the calculation of mileage between cities, the length of time a journey will take, the cost of such a journey, and so on. As the work on this page is completed, you might suggest that pupils bring to class descriptions of other ways in which decimal fractions are used. The bulletin board could well be used for the exhibition of these reports.

Key: **1.** 2.6 lb. **2.** 11.65 in. **3.** 1.49 in. **4.** 428.6 ft. **5.** 85.9 mi.; 544.3 mi.; 420.4 mi.; 964.7 mi. **6.** 17.3 mi. **7.** 3.7 mi. **8.** 102.6 mi.

Page 133

Aim: To present larger magic squares in which 12 sums must be alike

Suggestions: A magic square is one in which each horizontal row of numbers, each vertical column of numbers, and each diagonal row all have the same sum. If any row, column, or diagonal does not have this sum, the square is not a magic square. In ex. 4 and 5 on this page, certain numbers have to be supplied so that the square will be a magic square. In ex. 4 the missing number in the second row is found as follows: Add the numbers in the first row to find what the sum should be; then add the 4 numbers in the second row and subtract the result from the sum found in the first row. The result will be the missing number in the second row. Proceed in a similar manner to find the other missing numbers. Remember that every row, every column, and both diagonals must have the same sum.

Key: **1.** Yes, all sums equal 65. **2.** Yes, all sums equal 65. **3.** Yes, all sums equal 60.

4. Sum: 260

53	42	56	45	64
61	50	44	58	47
49	63	52	41	55
57	46	60	54	43
40	59	48	62	51

5. Sum: 65

23	1	2	20	19
22	16	9	14	4
5	11	13	15	21
8	12	17	10	18
7	25	24	6	3

Page 134

Aim: To review the skills of adding, subtracting, and multiplying common fractions and mixed numbers

Suggestions: The work on this page is carefully graded. Most examples are arranged so that examples increase in difficulty as the pupil goes from left to right.

Key: **1.** $9\frac{1}{4}$; $3\frac{2}{3}$; $5\frac{2}{3}$; $8\frac{5}{6}$. **2.** 9; $7\frac{1}{4}$; $11\frac{3}{4}$; $6\frac{13}{16}$. **3.** $8\frac{3}{4}$; $2\frac{3}{10}$; $3\frac{5}{12}$; $3\frac{1}{2}$. **4.** $3\frac{3}{4}$; $7\frac{1}{2}$; $\frac{1}{2}$; 1; 5. **5.** $\frac{3}{4}$; $\frac{4}{5}$; $\frac{2}{3}$; $\frac{3}{7}$; $\frac{1}{2}$; $\frac{3}{5}$; $\frac{1}{4}$. **6.** $3\frac{1}{3}$; $4\frac{1}{4}$; $12\frac{1}{2}$; $1\frac{1}{2}$; $3\frac{1}{2}$; $1\frac{1}{2}$. **7.** $\frac{9}{2}$; $\frac{25}{4}$; $\frac{19}{8}$; $\frac{35}{4}$; $\frac{31}{3}$; $\frac{25}{2}$; $\frac{103}{5}$. **8.** $7\frac{7}{8}$; $9\frac{1}{3}$; $8\frac{1}{12}$; $10\frac{5}{24}$; $7\frac{1}{4}$; 10; $9\frac{11}{16}$. **9.** $2\frac{5}{12}$; $3\frac{1}{12}$; $4\frac{5}{8}$; $\frac{11}{12}$; $1\frac{1}{3}$; $5\frac{3}{8}$; $3\frac{1}{20}$. **10.** $3\frac{1}{2}$; $2\frac{1}{2}$; $5\frac{3}{8}$; $\frac{5}{6}$; $5\frac{9}{16}$; $3\frac{1}{2}$; $3\frac{5}{6}$. **11.** $\frac{4}{9}$; $\frac{3}{4}$; 1; 6. **12.** $1\frac{7}{8}$; 9; 2; 42. **13.** $2\frac{1}{2}$; $2\frac{1}{2}$; $1\frac{1}{4}$; $1\frac{9}{16}$. **14.** $\frac{1}{8}$; $8\frac{1}{3}$; $2\frac{7}{10}$; 2. **15.** $\frac{2}{3}$; 2; 15; $5\frac{1}{4}$.

Page 135

Aim: To practice changing decimal fractions to common fractions

Suggestions: The changing of decimal fractions to common fractions is not so common as the reverse operation of changing common fractions to decimal fractions. Since decimal fractions are much easier to manipulate and calculate, the usual procedure is to change common fractions and mixed numbers to decimal fractions and mixed decimal numbers before attempting multiplication and division. However, pupils should realize that any decimal fraction may be written as a common fraction. This fact helps them to verify certain answers they will secure later when decimal fractions are first manipulated. Naturally, the pupils will want to discover the rules for placing decimal points in products and quotients. If decimal fractions can be changed to common fractions, the pupils may then multiply or divide the common fractions and thus check on the accuracy of their work with decimal fractions. Pupils will, however, quickly abandon the changing of decimal to common fractions when they realize the great ease of calculation with the decimal fraction: no changing of mixed numbers to improper fractions, no inversion, no simplification of the fraction in the answer, no seeking the least common denominator. The decimal fraction allows pupils to use the rules for addition, subtraction, multiplication, and division that they have practiced with whole numbers since Grade 3. *The only new learning* is the placement of the decimal point in the answer, a relatively simple skill to master.

Workbook Reference: Arithmetic Workshop, Book 6, page 55

Key: **2.** $\$\frac{75}{100} = \$\frac{3}{4}$. **3.** $\frac{1}{4}$; $\frac{1}{2}$; $\frac{3}{10}$; $\frac{13}{20}$; $\frac{8}{25}$; $\frac{3}{5}$; $\frac{17}{20}$. **4.** $\frac{9}{10}$; $\frac{6}{25}$; $\frac{13}{25}$; $\frac{11}{25}$; $\frac{3}{20}$; $\frac{19}{25}$; $\frac{7}{25}$. **8.** $\frac{5}{8}$; $\frac{1}{4}$; $\frac{13}{20}$; $\frac{1}{8}$; $\frac{3}{4}$; $\frac{7}{40}$. **9.** $\frac{17}{40}$; $\frac{7}{8}$; $\frac{13}{40}$; $\frac{29}{40}$; $\frac{11}{40}$; $\frac{9}{20}$.

Page 136

Aim: To teach the meaning of a tenth of a cent and ways of writing it

Suggestions: The work on this page is very important since it shows how to interpret money numbers having three decimal places. The pupils should try to remember that in writing dollars and cents a figure in the thousandths place represents tenths of a cent. It will be necessary to make use of this fact in the subsequent work in *American Arithmetic, Grade 6.*

Key: **3.** \$.861. **5.** \$.387; \$.635; \$.375; \$.453; \$.525; \$.096; \$1.435. **6.** $\$.26\frac{3}{10}$; $\$.73\frac{4}{5}$; $\$.24\frac{1}{2}$; $\$.53\frac{3}{5}$; $\$.19\frac{1}{10}$; $\$.12\frac{1}{2}$; $\$.34\frac{1}{5}$. **7.** $\$1.49\frac{5}{10}$, $\$1.49\frac{1}{2}$; $\$.07\frac{5}{10}$, $\$.07\frac{1}{2}$, $7\frac{1}{2}$¢; $\$.62\frac{5}{10}$, $\$.62\frac{1}{2}$, $62\frac{1}{2}$¢; $\$4.37\frac{5}{10}$, $\$4.37\frac{1}{2}$; $\$.09\frac{4}{10}$, $\$.09\frac{2}{5}$, $9\frac{2}{5}$¢; $\$.33\frac{7}{10}$, $33\frac{7}{10}$¢; $\$2.18\frac{4}{10}$, $\$2.18\frac{2}{5}$.

Page 137

Aim: To extend the multiplication of whole numbers to 4-figure multiplicands and 3-figure multipliers

Suggestions: In presenting the new work on this page, it will be helpful if the four examples in ex. 4 are placed on the blackboard so that each step of the work can be pointed out to the pupils. Attention is called to the fact that certain of these examples are incorrectly worked. Hence, the pupils must find the mistakes and show how they can be corrected. In the third example in ex. 4, the multiplier is 740 and is so written under 6149 that the 0 of 740 stands out at the right. This method is the approved one for writing a multiplier when it ends in 0; a similar practice is followed in the fourth example.

Workbook Reference: Arithmetic Workshop, Book 6, page 57

Key: **1.** 793,875 meals. **2.** 1,204,500 eggs. **3.** 1,204,500 ÷ 360 = 3345 R300, or about 3346 cases of eggs.

4.	6548	7003	6149	2670
	475	608	740	830
	32740	56024	245960	80100
	45836	420180	43043	21360
	26192	4257824	4550260	2216100
	3110300			

5. 324,945; 2,879,558; 422,282; 3,941,091; 4,325,850. **6.** 1,966,587; 1,802,074; 6,695,276; 1,635,434; 633,600. **7.** 2,164,576; 730,355; 3,001,840; 559,312; 1,877,010. **8.** 6,340,360; 335,787; 7,915,492; 1,158,456; 2,768,300. **9.** 4,477,462; 977,820; 2,020,256; 2,496,720; 1,158,680. **10.** 303,850; 3,909,750; 1,520,519; 1,411,200; 374,870.

Page 138

Aim: To present problems dealing with decimal fraction measures

Suggestions: Snowfall, distance, and money are the three uses of decimal fractions as found on this page. The pupils will conclude, in all probability, that the common fraction is easier to use when amounts such as $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{3}{4}$ are used and where calculations are relatively simple.

Key: **1.** 4.8 in. + 2.5 in. = 7.3 in. **2.** 3 hr. 30 min. = $3\frac{1}{2}$ hr.; $3\frac{1}{2} \times \$.60 = \$2.10$. **3.** 5 × 460 mi. = 2300 mi. **4.** 165 mi. ÷ 4 = $41\frac{1}{4}$ mi. **5.** 6076.10 ft. − 5280 ft. = 796.10 ft. **6.** 96.8 ft. + 45.5 ft. + 96.8 ft. + 45.5 ft. = 284.6 ft. **7.** 20 min. = $\frac{1}{3}$ hr.; $\frac{1}{3} \times 7\frac{1}{2} = 2\frac{1}{2}$ (hr.). **8.** 18 ft. 6 in. = $18\frac{1}{2}$ ft., $12 \times 18\frac{1}{2} = 222$ (sq. ft.), 15 ft. × 15 ft. = 225 sq. ft., 225 sq. ft. − 222 sq. ft. = 3 sq. ft.; so the square is 3 sq. ft. larger. **9.** 12 ft. + $18\frac{1}{2}$ ft. + 12 ft. + $18\frac{1}{2}$ ft. = 61 ft., 15 ft. + 15 ft. + 15 ft. + 15 ft. = 60 ft., 61 ft. − 60 ft. = 1 ft.; so the rectangle has a perimeter 1 ft. larger. **10.** $3\frac{1}{2} \times 8¢ = 28¢$, $\frac{3}{4} \times 59¢ = 44\frac{1}{4}¢$, or 45¢, 28¢ + 45¢ + 15¢ = 88¢. **11.** $\frac{1}{4} \times \$6.00 = \$1.50$; $\$6.00 - \$1.50 = \$4.50$. **12.** $48 \times \$12.37 = \$593.76$. **13.** 71.4 mi. + 35.8 mi. + 48.2 mi. + 37.0 mi. + 61.9 mi. = 254.3 mi.

Page 139

Aim: To present the second set of improvement tests in multiplication and the second set in division

Suggestions: A set of 3 improvement tests in multiplication and a set of 3 improvement tests in division are given on this page. Improvement tests in multiplication and division were first given on pages 74 and 95 of the text. The suggestions relating to those pages apply also to the tests on page 139. Remember that tests on both multiplication and division must be copied before they are taken. The time allowance for each of these tests does not include the time spent in copying.

Key: **1.** 276,210; 304,007; 103,168; 491,352; 690,525; 340,910. **2.** 310,338; 79,413; 83,070; 231,322; 857,472; 290,720. **3.** 361,372; 672,068; 401,920; 146,766; 417,696; 570,490. **4.** 58; 79; 64 R5. **5.** 29; 83 R10; 75. **6.** 74; 65 R13; 83. **7.** 27 R3; 92; 69. **8.** 53 R7; 74; 86. **9.** 67; 58 R6; 99.

Page 140

Aim: To review column addition of whole numbers and mixed decimal numbers

Suggestions: Review quickly with the class the matter of place value and the reason why the decimal points in column addition are in a straight line. Be alert for those pupils who add these columns slowly, and check on their skill in adding by endings.

Key: **1.** 55.7 mi. **2.** $2667.04. **3.** 1,159,570 sq. mi. **4.** 18.9; 40.7; 22.63; 769.3; 180.04; 20.750. **5.** 2.11; 1.357; 72.2; 13.400; 24.638; 101.21 **6.** 24,343; 29,307; 22,725; 27,803; 32,649; 27,183.

Page 141

Aim: To review problem solving and problems in which facts are missing

Suggestions: On page 142, where a missing fact is to be supplied for each problem, it should be understood that any missing fact that makes a sensible problem is acceptable. In a given problem no two pupils will supply the missing fact in the same way. For example, in ex. 1 one pupil may say that a camp stove costs $9.75 while another pupil may say $11.25.

Workbook Reference: Arithmetic Workshop, Book 6, page 58

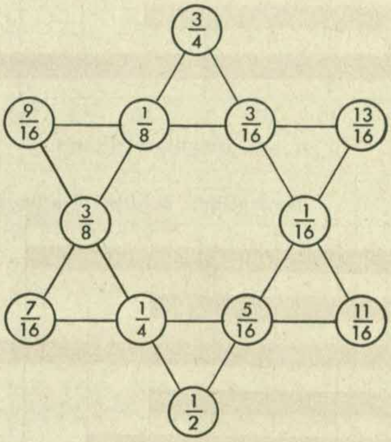
Page 142

Aim: To give an appreciation lesson on magic circles and stars

Suggestion: Pupils have experimented this year with magic squares. Here is an innovation in the form of magic stars and circles.

Key: **1.** The sums are all 164. **2.** $1\frac{15}{16}$, yes; $2\frac{1}{16}$, yes; $1\frac{1}{4}$, yes.

3.



Page 143

Aim: To review problem solving

Key: **1.** 8.4 mi. + 6.5 mi. = 14.9 mi. **2.** 8.4 mi. − 6.5 mi. = 1.9 mi. **3.** $1.79 + $1.59 + $3.75 = $7.13; $10.00 − $7.13 = $2.87. **4.** 30 × 6297 = 188,910 (passengers). **5.** 206 × 742 mi. = 152,852 mi. **6.** (1) 8 × $1\frac{1}{2}$¢ = 12¢; (2) 3 × $1\frac{1}{2}$¢ = $4\frac{1}{2}$¢; (3) $2\frac{1}{2}$ × $1\frac{1}{2}$¢ = $3\frac{3}{4}$¢. **7.** $11.50 + $9.25 + $7.75 = $28.50; $28.50 ÷ 3 = $9.50. **8.** 10,500 − 8225 = 2275 (people). **9.** 15 ft. 9 in. = $15\frac{3}{4}$ ft.; 20 ft. × $15\frac{3}{4}$ ft. = 315 sq. ft. **10.** (1) $3\frac{3}{8}$ yd. + $\frac{3}{4}$ yd. + $\frac{1}{2}$ yd. = $4\frac{5}{8}$ yd.; the dress could be cut from the $3\frac{1}{2}$-yd. piece with $\frac{1}{8}$ yd. over, and the scarf and the hat could be cut from the $1\frac{3}{8}$-yd. piece, with $\frac{1}{8}$ yd. over.

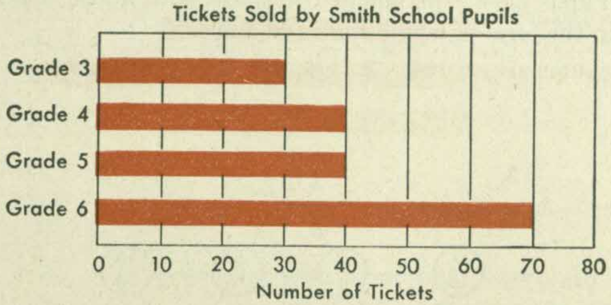
Page 144

Aim: To teach how to make bar graphs with large numbers that are first rounded off

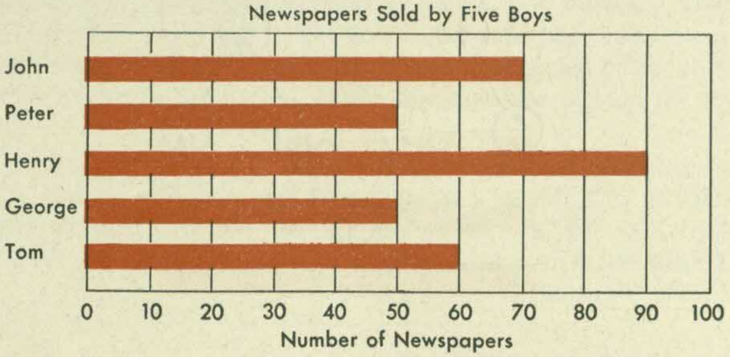
Suggestions: The pupils have already had some experience in rounding off 3-figure numbers to the nearest hundred. Hence, they have learned that 614 becomes 600 when rounded off to the nearest hundred, while 795 becomes 800 when rounded off. The work on page 144 shows how to round off 2-figure numbers to the nearest ten and hundred.

Key: **1.** Grade 5, $30; Grade 6, $40; Grade 7, $20; Grade 8, $60. **2.** $150. **3.** No, the bar for Grade 7 should be $30.

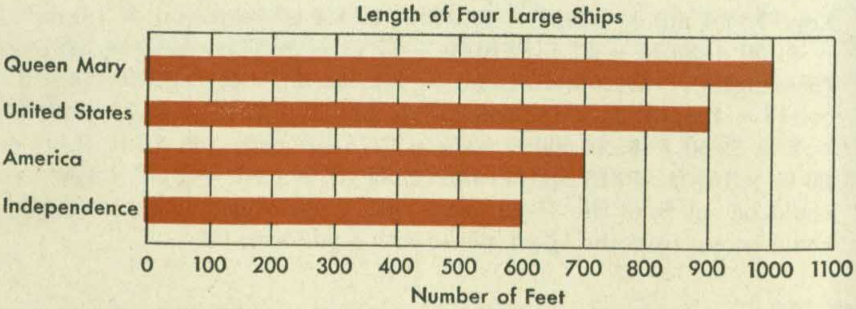
4.



5.



6.



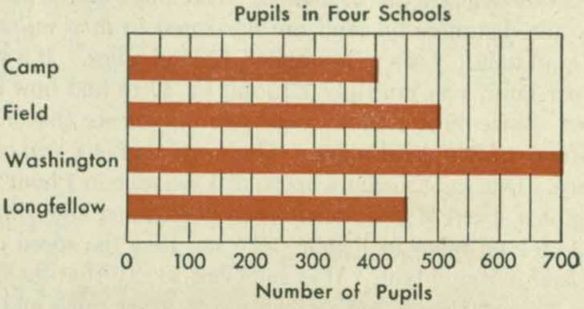
Page 145

Aim: To extend the work of reading and constructing bar graphs

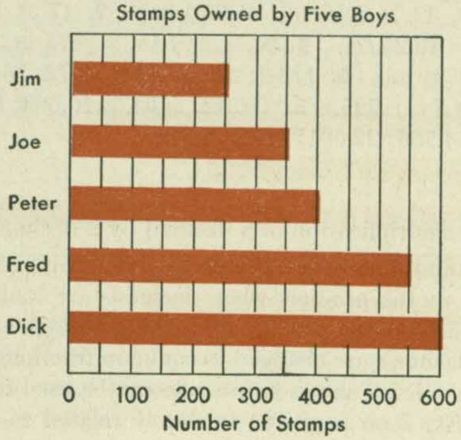
Suggestion: The bar graphs on page 144 dealt mostly with scores rounded off to the nearest 10. These graphs round off numbers to the nearest 50.

Key: **1.** 250; 400; 200; 800; 100. **2.** Story Books, 700; History Books, 400; Animal Books, 350; Travel Books, 300; Science Books, 250. **3.** The bars are right.

4.



5.



Page 146

Aim: To review fundamental operations with whole numbers

Key: **1.** 6337; 3968. **2.** 12,255; 1567. **3.** 9901; 46. **4.** 231 stamps. **5.** $87.89. **6.** $1235.82. **7.** $215.46; $217.92; $100.00; $189.37; $269.10. **8.** 2120; 3755; 2242; 4934; 5889; 478. **9.** 1832; 719; 2854; 4059; 4977. **10.** 1123; 2673; 5866; 6790; 476. **11.** 1989; 976; 2186; 3514; 3696. **12.** 6600, 10,425, 5852, 12,797, 9849; 5121, 7327, 11,190, 9984, 12,066; 14,411, 6070, 7832, 8486, 7484. **13.** 76; 385; $159\frac{20}{33}$; 678; 689. **14.** $35\frac{2}{41}$; $136\frac{19}{56}$; $103\frac{49}{62}$; 578; $960\frac{39}{77}$.

Pages 147–148

Aim: To teach the multiplication of decimals by whole numbers

Suggestions: In ex. 1 and 2 on page 147 the explanations will make this new work clear to the pupils.

In ex. 1 on page 148 the word *knot* should be carefully explained. First explain how distances at sea are measured. Distances on the ocean are measured in *sea miles* while distances on land are measured in *land miles.* A sea mile is *longer* than a land mile. 1 sea mile equals 1.15 land miles. If a steamship travels 30 sea miles per hour, you multiply 1.15 mi. by 30 to find how many land miles that would be. Since 30 × 1.15 mi. = 34.50 mi., you see that 30 sea miles is the same as a distance of 34.5 land miles. The word *knot* is a *unit of speed* and not a unit of distance. One knot means a speed of 1 sea mile in 1 hour; hence, a steamship traveling at a speed of 30 knots is traveling 30 sea miles in 1 hour, which is the same as 34.5 land miles in 1 hour. To say that the speed of a steamship is 30 knots *per hour* is redundant. It is sufficient to say that its speed is 30 knots, since the term 30 *knots* implies both a distance of 30 sea miles and a time of 1 hour.

Workbook Reference: Arithmetic Workshop, Book 6, page 60

Key: Page 148 **1.** 14 × 1.15 mi. = 16.1 mi. **2.** 17 × 1.15 mi. = 19.55 mi. **3.** 35 × 1.15 mi. = 40.25 mi. **4.** 25 × .007 in. = .175 in. **5.** (1) 6 × 4.65 mi. = 27.90 mi.; (2) 41.85 mi. **6.** 172.2; 285.3; .054; 18.72; 76.68; 2.622. **7.** 315.5; .035; .828; 52.32; 1.744; .295. **8.** 176.12; 5434.6; 10.693; 97.44; 68.208; 23.068. **9.** 1.275; 344.88; 14.768; 22.491; 71.02; 4.674.

Pages 149–151

Aim: To teach the multiplication of a decimal by a decimal

Suggestions: Ex. 1 and 2 on page 149 aim to give meaning to the rule for placing the decimal point in the product when decimals are multiplied. In ex. 1 the decimal point is placed in the product by making a rough estimate of the answer, while in ex. 2 the decimals are changed to common fractions in order to determine the correct answer. Ex. 3 shows how a rule can be used for placing the decimal point correctly. Ex. 7 on page 151 is closely related to ex. 1–3 on page 148. See the suggestions for teaching page 148.

Workbook Reference: Arithmetic Workshop, Book 6, page 61

Key: Page 149 **4.** Estimate: 63, exact: 64.584; estimate: 64, exact: 66.815; estimate: 405, exact: 423.80; estimate: 420, exact: 430.66.

Page 150 **1.** By estimating the answer; 79.8. **2.** 81.18; 57.82. **4.** 20.88; .455; 20.8; 8.544; 962.5; 8.757. **5.** 7.54; .672; 63.0; 1.332; 4582.8; 22.375. **6.** 4.56; .155; 27.0; 3.312; 144.44; 6.966. **7.** 71.89; .378; 23.5; 3.139; 132.84; 298.57. **8.** 27.52; .340; 34.2; 1.575; 117.48; 43.378. **9.** 2.24; .344; 72.0; 2.052; 437.61; 26.264. **10.** 14.11; .162; 56.7; 1.924; 9.334; 37.812.

Page 151 **2.** 6 × 17.4 mi. = 104.4 mi. **3.** (1) .78 × 5 lb. = 3.90 lb.; (2) 6.24 lb. **4.** 12 × 2.78 in. = 33.36 in. **5.** 2.5 × $12.50 = $31.25. **6.** $2\frac{1}{2} \times \$12\frac{1}{2} = \$31\frac{1}{4}$; yes. **7.** 692 × 1.15 = 795.80 (land miles).

Page 152

Aim: To teach how to handle zero difficulties in the multiplication of a decimal by a decimal

Suggestion: The purpose of ex. 2 on this page is to verify the procedure used in ex. 1.

Key: **3.** $.2 \times .04 = .008, \frac{2}{10} \times \frac{4}{100} = \frac{8}{1000}$; yes. **4.** .048; .066; .098; .225. **5.** .027; .119; .084; .066. **6.** .009; .252; .195; .078. **7.** .028; .135; .016; .96. **8.** .072; .268; .136; .009. **9.** .055; .096; .168; .092. **10.** .072; .585; .252; .175.

Page 153

Aim: To give practice in placing the decimal point in a product

Workbook Reference: Arithmetic Workshop, Book 6, pages 62 and 63

Key: **1.** 12.32. **2.** 6.629. **3.** .28. **4.** .035. **5.** 130.0. **6.** 196.8. **7.** 16.53. **8.** 17.15. **9.** Six-point-three; two-two-point-four; point-o-five-six; seven-point-one-four; eight-point-five-eight-two; eight-four-point-eight-seven. **10.** Point-five-six; point-five-seven-six; one-point-one-seven; point-o-four-two; point-one-seven-five; two-seven-point-four-seven. **11.** Point-o-nine; point-six-six; point-four-nine-o; point-o-six-four; eight-one-point-o-o; point-o-seven-eight. **12.** Point-o-eight; point-two-five-five; point-one-four-six; point-six-five-o; two-point-seven-two-four; one-one-point-five-o. **13.** $.2 \times .02 = .004, \frac{2}{10} \times \frac{2}{100} = \frac{4}{1000}$; yes.

Page 154

Aim: To provide mixed practice with special attention to common and decimal fractions

Suggestions: Some of the examples on this page can be done mentally by the better pupils. Urge them to complete mentally as many of these as possible. Page 156 will have a complete page of more simple mental exercises.

Workbook Reference: Arithmetic Workshop, Book 6, page 64

Key: **1.** 4 lb. = 64 oz.; 64 oz. + 12 oz. = 76 oz. **2.** 4 qt. = 1 gal.; $\frac{2}{4} = \frac{1}{2}$ (gal.). **3.** 6. **4.** $231.66. **5.** 18,237. **6.** $12\frac{3}{8}$. **7.** $\frac{3}{4} \times 120 = 90$, $\frac{2}{3} \times 120 = 80$; so $\frac{3}{4}$ of 120 is 10 more. **8.** 150¢ + 325¢ + 60¢ + 55¢ = 590¢. **9.** (1) $22\frac{1}{2} \times 28 = 630$ (sq. ft.); (2) 28 ft. + $22\frac{1}{2}$ ft. + 28 ft. + $22\frac{1}{2}$ ft. = 101 ft. **10.** 125 × $.094 = $11.75. **12.** 46.52. **13.** 64.435. **14.** $5\frac{3}{4}$. **15.** $15\frac{2}{3}$. **16.** 2572. **17.** 506. **18.** $9000.00. **19.** $35\frac{3}{4}$. **20.** 510,057. **21.** $17\frac{1}{2}$.

Page 155

Aim: To extend problems without numbers to include two-step and three-step problems

Key: **1.** Subtract; multiply by $\frac{1}{2}$. **2.** Multiply; multiply; add. **3.** Divide. **4.** Add. **5.** Subtract. **6.** Add. **7.** Divide.

Page 156

Aim: To provide activity in mental arithmetic

Key: **1.** 2.8. **2.** $2\frac{1}{4}$. **3.** 8.6; .86; .086. **4.** $1\frac{1}{2}$. **5.** .6; 4.5. **6.** 10; $6\frac{2}{3}$; $8\frac{3}{4}$. **7.** 9; $12\frac{1}{2}$; $\frac{1}{4}$; $\frac{3}{4}$; $1\frac{1}{3}$. **8.** 12; 18; 27; 33; 60. **9.** 60¢. **10.** 71; 53; 64; 97; 86. **11.** 74 min. **12.** 5; 8; 3 R1; 9 R1; 5 R3. **13.** 42 million, 760 thousand, 184; 1 billion, 703 million, 45 thousand, 9. **14.** 1705; 1960; 1612. **15.** 24 in.; 72 in.; 6 in. **16.** 8.5 mi. **17.** 3 mi. **18.** 4 pieces; 6 pieces. **19.** 5 mi.; $7\frac{1}{2}$ mi. **20.** 20 dimes; 15 dimes. **21.** 26¢; 38¢.

Page 157

Aim: To review the major aims of Chapter 4

Suggestions: This test reviews 6 of the 11 major aims of the chapter as outlined in this Guide at the beginning of the chapter These are:

Chapter Review	*Aim Number*
Ex. 1–4	4
Ex. 5 and 6	2
Ex. 7–9	5
Ex. 10	7 and 8
Ex. 11 and 12	9

Key: **1.** .17; .734; .3; .07; .023; .007. **2.** .04; .012; .9; .35; .005; .193. **3.** $\frac{47}{100}$; $\frac{4}{5}$; $\frac{1}{2}$; $\frac{87}{250}$; $\frac{3}{40}$; $\frac{1}{500}$. **4.** $\frac{3}{100}$; $\frac{2}{25}$; $\frac{7}{10}$; $\frac{7}{25}$; $\frac{39}{1000}$; $\frac{1}{1000}$. **5.** 10.1; .666; 33.19; .758; 14.43; 9.125. **6.** 19.2; 1.143; 77.36; 1.304; 23.98; 10.497. **7.** 3.5; .168; 6.39; .375; 4.33; 1.375. **8.** 4.4; 10.4; 14.21; .524; 5.77; 7.725. **9.** 59.5; 44.16; 2.738; 1.344; 34.20; 10.024. **10.** 1,269,312; 1,048,320; 1,358,586; 850,900; 1,102,140. **11.** 1,059,123; 1,506,640; 2,954,898; 1,383,300; 5,700,480.

Page 158

Aim: To present Problem Test 4

Workbook Reference: Arithmetic Workshop, Book 6, page 65

Key: **1.** $\frac{2}{3} \times \frac{3}{4} = \frac{1}{2}$ (cup). **2.** $8\frac{1}{2}$ ft. + $12\frac{3}{4}$ ft. = $21\frac{1}{4}$ ft.; 50 ft. − $21\frac{1}{4}$ ft. = $28\frac{3}{4}$ ft. **3.** 2 × \$270 = \$540; \$540 − \$486 = \$54. **4.** 4 × \$.65 = \$2.60; \$2.60 − \$2.25 = \$.35. **5.** $1\frac{3}{4}$ yd. + $1\frac{3}{4}$ yd. = $3\frac{1}{2}$ yd.; 10 yd. − $3\frac{1}{2}$ yd. = $6\frac{1}{2}$ yd. **6.** $6\frac{5}{8}$ × \$.49 = \$3.24$\frac{5}{8}$, or \$3.25. **7.** 9.2 mi. + 4.5 mi. + 10.6 mi. = 24.3 mi. **8.** 350 × \$.085 = \$29.75. **9.** 13.2 in. − 8.4 in. = 4.8 in. **10.** 75 × \$.12 = \$9.00; \$4.00 + \$3.25 + \$1.60 + \$.15 = \$9.00; yes.

Pages 159–160

Aim: To present diagnostic tests with references for additional practice exercises

Suggestion: These pages may be used as a mid-year test in arithmetic skills.

Workbook Reference: Arithmetic Workshop, Book 6, pages 59 and 64

Key: Page 159 **1.** 643 R21; 935 R18; 7049 R56. **2.** 817 R20; 384 R29; 8294 R28. **3.** $\frac{17}{20}$; $\frac{3}{50}$; $\frac{9}{125}$; $\frac{81}{200}$. **4.** 20.1; 16.30; \$10.92; 22.025. **5.** 2.7; 2.85; \$4.25;

1.875. **6.** 7.2; .54; .028; 4.116. **7.** .441; 1.040; 15.015; 9.251. **8.** .096; .096; .125; 0.072. **9.** 1,566,950; 2,577,665; 816,442; 2,479,400.

Page 160 **1.** $11\frac{7}{8}$; $9\frac{3}{4}$; $13\frac{1}{4}$; $14\frac{7}{12}$, $16\frac{5}{12}$. **2.** $4\frac{1}{4}$; $6\frac{1}{2}$; $3\frac{1}{2}$; $6\frac{5}{12}$; $3\frac{5}{12}$. **3.** 20; 18; 7. **4.** 22; 27; 39. **5.** $13\frac{1}{3}$; $6\frac{3}{5}$; $10\frac{5}{6}$. **6.** $22\frac{1}{2}$; $23\frac{1}{3}$; $63\frac{3}{4}$. **7.** $1\frac{1}{5}$; $2\frac{1}{2}$; 10. **8.** $40\frac{1}{2}$; 14; $8\frac{3}{4}$. **9.** $\frac{1}{12}$; $\frac{8}{15}$; $\frac{3}{16}$. **10.** $\frac{1}{16}$; $\frac{2}{5}$; $\frac{3}{10}$. **11.** 4; 6; $3\frac{1}{2}$. **12.** $\frac{1}{5}$; $\frac{1}{2}$; $\frac{1}{2}$. **13.** $6\frac{2}{3}$; $4\frac{1}{2}$; $3\frac{3}{4}$. **14.** $\frac{4}{5}$; $\frac{5}{12}$; $\frac{3}{4}$. **15.** $1\frac{7}{8}$; $\frac{3}{8}$; 6.

Chapter 5

Aims of Chapter 5. The major aims of Chapter 5 are to:

1. Review the skills and understandings taught in previous chapters.
2. Teach and use the tests of divisibility.
3. Teach 3-figure division with reference to Rule I and Rule II.
4. Teach division of common fractions and mixed numbers.
5. Teach how to compare numbers by division.
6. Teach a method for finding the whole amount when a fractional part is known.

Pages 161–162

Aim: To present an interesting social-studies project

Suggestion: The numerical facts used in this project on Hoover Dam are authoritative.

Key: Page 161 **1.** 56 × 13 ft. = 728 ft.; yes. **2.** (1) 726 ft. − 602 ft. = 124 ft.; (2) 726 ft. − 564 ft. = 162 ft.

Page 162 **1.** $\frac{1}{4}$ × 5280 ft. = 1320 ft.; 1320 ft. − 1244 ft. = 76 ft.; yes, 76 ft. less. **2.** 5,000,000 × 376 lb. = 1,880,000,000 lb. **3.** (1) 36 × 300 barrels = 10,800 barrels; (2) 10,800 × 376 lb. = 4,060,800 lb. **4.** 255 × 640 acres = 163,200 acres. **5.** $\frac{1}{6}$ × 255 sq. mi. = $42\frac{1}{2}$ sq. mi., $\frac{1}{7}$ × 255 sq. mi. = $36\frac{3}{7}$ sq. mi.; so the lake at Hungry Horse Dam is about $\frac{1}{7}$ the size of Lake Mead, since $36\frac{3}{7}$ sq. mi. is closer to 38 sq. mi. **7.** (1) \$125,000,000; (2) \$125,000,000 ÷ 17 = $\$7{,}352{,}941\frac{3}{17}$, or about \$7,353,000.

Pages 163–164

Aims: To teach the more important tests of divisibility and to apply this work in simplifying fractions with large denominators

Suggestions: The more important tests of divisibility are given on this page. You should remember that a test of divisibility is merely a short way of finding whether a number is divisible by 2, 3, 5, or 9 without actually dividing the number to find out. These tests of divisibility will be found very helpful in the pupils' further use of arithmetic; hence, the pupils should become thoroughly acquainted with them and even memorize them. The terms *even number* and *odd number* should be made clear. Important uses of tests of divisibility are explained on page 164.

Key: Page 163 **7.** (By 2) 176, 170, 192, 2520, 3474; (by 3) 531, 633, 192, 2520, 3474; (by 5) 170, 2520; (by 9) 531, 2520, 3474. **8.** (By 2) 162, 426, 354, 4228; (by 3) 315, 162, 603, 426, 354, 5085; (by 5) 315, 5085; (by 9) 315, 162, 603, 5085. **9.** (By 2) 236, 504, 5346, 2790; (by 3) 219, 747, 504, 5346, 2790; (by 5) 2790; (by 9) 747, 504, 5346, 2790.

Page 164 **2.** $\frac{1}{8}$ mi.; $\frac{1}{6}$ mi.; $\frac{3}{4}$ mi. **3.** $\frac{3}{4}$ hr.; $\frac{2}{3}$ hr.; $\frac{3}{10}$ hr. **4.** $16\frac{2}{5}$ hr. **5.** $\frac{1}{2}$; $\frac{2}{3}$; $\frac{7}{10}$; $\frac{4}{5}$; $\frac{1}{3}$; $\frac{4}{5}$; $\frac{5}{7}$; $\frac{6}{7}$. **6.** $\frac{2}{3}$; $\frac{3}{4}$; $\frac{3}{4}$; $\frac{5}{8}$; $\frac{17}{70}$; $\frac{5}{6}$; $\frac{3}{5}$; $\frac{3}{8}$. **7.** $\frac{3}{5}$; $\frac{5}{8}$; $\frac{5}{13}$; $\frac{3}{8}$; $\frac{3}{5}$; $\frac{8}{25}$; $\frac{3}{5}$; $\frac{1}{3}$. **8.** $\frac{2}{5}$; $\frac{3}{5}$; $\frac{14}{15}$; $\frac{3}{8}$; $\frac{3}{4}$; $\frac{8}{13}$; $\frac{5}{8}$; $\frac{3}{5}$. **9.** $\frac{5}{6}$; $\frac{4}{5}$; $\frac{5}{12}$; $\frac{6}{11}$; $\frac{2}{5}$; $\frac{5}{8}$; $\frac{1}{7}$; $\frac{3}{5}$.

Pages 165–166

Aim: To teach long division with 3-figure divisors

Suggestions: The method of doing long division with 3-figure divisors as presented on these pages has the same high efficiency as the method used in this book for 2-figure divisors. That is, this method gives the correct quotient figure on first trial in 80% of all cases. In the remaining 20% of the cases the correct quotient figure is found, with minor exceptions, after a single correction of the trial quotient figure. Page 165 gives the rule for estimating quotient figures when the second figure of the 3-figure divisor is 1, 2, 3, 4, or 5. For convenience this is called Rule I and corresponds to Rule I as used for 2-figure divisors, which is given on page 29 of the text.

On page 166 there are 21 exercises to provide practice in using the skill taught on page 165.

Workbook Reference: Arithmetic Workshop, Book 6, page 44

Key: Page 165 **2.** 5; 5 R8; 31; 24. **3.** 6; 4 R47; 37; 27. **4.** 4 R14; 9; 26; 36. **5.** 4 R11; 5; 15; 32.

Page 166 **2.** 52; 32 R12; 275. **3.** 62; 65 R87; 587. **4.** 48; 72 R102; 319. **5.** 94 R171; 52 R7; 372 R532. **6.** $72\frac{1}{9}$; 64; $221\frac{4}{91}$. **7.** 75; $48\frac{3}{35}$; $367\frac{1}{13}$. **8.** $58\frac{9}{29}$; 46; $974\frac{2}{9}$.

Page 167

Aims: To give another set of improvement tests in addition and to review important arithmetical terms

Suggestions: A new set of improvement tests in addition is given on this page. These tests should be given in the same way in which the first set of such tests was given. The vocabulary tests which follow the improvement tests are an oral activity and are most important.

Key: **1.** \$89.74; \$217.69; \$68.70; \$105.49; \$107.90. **2.** \$190.26; \$121.29; \$95.23; \$130.54; \$256.14. **3.** \$204.23; \$173.24; \$197.98; \$174.44; \$125.60.

Page 168

Aim: To apply Rule II to 3-figure divisors

Suggestions: This work is an extension of the instruction begun on page 165 with 3-figure divisors. In these examples the tens figure of the divisor is 6, 7, 8, or 9, thus making Rule II operative. Students who wish to review the use of Rule II with 2-figure divisors should be directed to restudy page 32.

Workbook Reference: Arithmetic Workshop, Book 6, page 45

Key: **2.** 37; 325; 517. **3.** 46 R151; 264 R79; 586. **4.** 18; 275 R93; 624.

Page 169

Aim: To present certain zero difficulties in division in examples with 3-figure divisors

Suggestion: The model examples in ex. 1 should be studied carefully before the other work on page 169 is attempted.

Key: **2.** 29,200 mi. ÷ 365 = 80 mi. **3.** \$698.34 ÷ 226 = \$3.09. **4.** 26,259 lb. ÷ 243 = $108\frac{5}{81}$ lb., or about 108 lb. **5.** 7615 mi. ÷ 193 = $39\frac{88}{193}$ mi., or about 39 mi. **6.** 60; $40\frac{3}{32}$; $207\frac{1}{2}$; 306. **7.** $27\frac{9}{47}$; 50; $270\frac{2}{23}$; 503. **8.** 8365; 2050; \$5.40$\frac{1}{8}$. **9.** 9982; 6002; \$6.74. **10.** $5263\frac{1}{3}$; 8040; \$7.45$\frac{1}{13}$.

Page 170

Aim: To review previous work with fractions before starting the work on the division of fractions

Suggestion: All steps in addition, subtraction, and multiplication of common fractions are redeveloped on this page. Pupils who hesitate in completing these examples should be allowed to STOP at this point until mastery is assured. The work on page 171 and following pages deals with division of fractions and is based on the assumption that pupils thoroughly understand the other three fundamental operations.

Key: **1.** (1) $28 \times \frac{1}{4}$ lb. = 7 lb.; (2) $23 \times \frac{1}{4}$ lb. = $5\frac{3}{4}$ lb.; (3) $25 \times \frac{1}{4}$ lb. = $6\frac{1}{4}$ lb. **2.** $5\frac{3}{4}$ × \$.45 = \$2.58$\frac{3}{4}$ or \$2.59. **3.** $5\frac{1}{4}$ mi. − $3\frac{1}{2}$ mi. = $1\frac{3}{4}$ mi. **4.** $13\frac{5}{8}$; $8\frac{1}{2}$; $4\frac{5}{6}$; $10\frac{7}{12}$; $4\frac{3}{10}$; $11\frac{1}{8}$; $14\frac{3}{4}$. **5.** $2\frac{3}{5}$; $2\frac{3}{10}$; $5\frac{17}{24}$; $\frac{5}{8}$; $4\frac{1}{4}$; $1\frac{1}{3}$; $3\frac{7}{16}$. **6.** 6; $\frac{3}{8}$; $\frac{1}{6}$; 1; $11\frac{3}{8}$. **7.** $\frac{3}{16}$; $\frac{1}{4}$; $\frac{7}{12}$; $3\frac{1}{2}$; 33. **8.** $5\frac{1}{4}$; $\frac{3}{10}$; $6\frac{2}{3}$; 3; $18\frac{3}{4}$. **9.** $\frac{1}{4}$; $5\frac{1}{4}$; $\frac{1}{8}$; $\frac{1}{2}$; $17\frac{1}{2}$. **10.** $2\frac{1}{2}$; $\frac{1}{2}$; $2\frac{2}{5}$; $3\frac{1}{2}$; 6. **11.** $2\frac{4}{5}$; $2\frac{2}{5}$; $\frac{3}{32}$; $\frac{3}{4}$; 18.

Pages 171–173

Aim: To provide practice experiences in dividing whole numbers by fractions

Suggestions: The examples on these pages give ample practice in the skill of inversion. The general rule is not presented until the middle of page 173 so that pupils will have ample opportunity to discover the rule for themselves before being told what it is. Such presentation is a feature of *American Arithmetics,* since the authors believe that pupils should be led to the discovery of a generalization rather than be told categorically that it exists.

Workbook Reference: Arithmetic Workshop, Book 6, page 68

Key: Page 171 **4.** $4 \div \frac{1}{2} = 8$. **5.** $5 \div \frac{1}{4} = 20$. **6.** (1) $3 \div \frac{1}{6} = 18$ (pieces); (2) $3 \div \frac{1}{8} = 24$ (pieces); (3) $3 \div \frac{1}{5} = 15$ (pieces).

Page 172 **2.** $\frac{4}{1}$; $\frac{3}{2}$; $\frac{4}{5}$; $\frac{1}{6}$; $\frac{4}{3}$; $\frac{1}{5}$; $\frac{8}{9}$. **4.** $6 \times \frac{2}{1} = 12$ (halves of an inch). **5.** $4 \div \frac{1}{8} = 4 \times \frac{8}{1} = 32$ (eighths of a yard). **6.** $12 \div \frac{1}{4} = 12 \times \frac{4}{1} = 48$ (fourths of a pound). **7.** 18; 16; 16; 9; 24. **8.** 20; 36; 42; 24; 45. **9.** 24; 10; 28; 24; 32. **10.** 30; 24; 18; 10; 36. **11.** 6; 20; 48; 12; 40.

Page 173 **1.** 4 times. **5.** 5; $9\frac{3}{5}$; $3\frac{3}{5}$; 16; 48. **6.** $6\frac{2}{3}$; $7\frac{1}{5}$; 10; 24; 20. **7.** 6; $10\frac{2}{3}$; $13\frac{1}{2}$; 32; $16\frac{2}{3}$.

Pages 174–175

Aim: To teach division of a mixed number or a fraction by a fraction

Suggestions: The sample examples give a careful explanation of the new step involved in this process. Students are already familiar with the idea that in multiplying by mixed numbers, it is necessary to change to improper fractions. Teachers may associate this idea with the new step explained on this page. Once again the close association between multiplication and division is stressed. Also it should be emphasized that the quotient must be changed back to a mixed number and any fractional amount reduced to lowest terms.

Workbook Reference: Arithmetic Workshop, Book 6, pages 69 and 70

Key: Page 174 **4.** 16; $6\frac{1}{4}$; $2\frac{1}{4}$. **5.** $1\frac{1}{2}$; $5\frac{1}{3}$; 2. **6.** 8; $1\frac{1}{2}$; $6\frac{2}{3}$. **7.** $8\frac{1}{4}$; $2\frac{1}{2}$; $5\frac{1}{3}$. **8.** $4\frac{1}{2}$; $7\frac{1}{2}$; $\frac{2}{3}$.

Page 175 **1.** $4\frac{1}{2} \div \frac{1}{4} = 18$ (bags). **2.** $2\frac{1}{4} \div \frac{3}{4} = 3$ (towels). **3.** $7\frac{1}{2} \div \frac{3}{8} = 20$ (boxes). **4.** 4; 6; $2\frac{1}{4}$; $\frac{5}{6}$; 4. **5.** $8\frac{8}{9}$; $5\frac{1}{3}$; $1\frac{1}{2}$; $\frac{9}{20}$; $1\frac{2}{3}$. **6.** $18\frac{2}{3}$; 4; $1\frac{1}{4}$; $1\frac{1}{4}$; $\frac{3}{4}$. **7.** 18; 12; $2\frac{1}{2}$; 4; $1\frac{1}{3}$. **8.** 6; $12\frac{1}{2}$; $\frac{11}{12}$; $2\frac{1}{2}$; $1\frac{1}{5}$. **9.** $1\frac{1}{2}$; $16\frac{2}{3}$; $\frac{1}{8}$; 6; $2\frac{2}{3}$. **10.** 7; $3\frac{3}{4}$; $\frac{3}{8}$; $\frac{3}{5}$; $2\frac{1}{2}$. **11.** $3\frac{1}{3}$; 10; $\frac{1}{4}$; $\frac{5}{6}$; $5\frac{1}{4}$. **12.** $\frac{1}{2}$; $1\frac{1}{9}$; $2\frac{1}{2}$; 11; $1\frac{2}{9}$. **13.** $\frac{3}{10}$; $\frac{3}{4}$; $4\frac{1}{5}$; $3\frac{3}{4}$; $6\frac{2}{5}$. **14.** $1\frac{2}{3}$; 2; $11\frac{1}{4}$; 8; $12\frac{1}{2}$.

Pages 176–177

Aim: To present problems dealing with United States history

Suggestions: The story of the manner in which our forefathers bought the land which spread our country from coast to coast is most fascinating. These problems are correlated with history and provide an excellent readiness for the study of United States history in Grade 7 or 8. Not only is arithmetic involved in the reading of large numbers, but questions about the cost of different areas of our country are interesting to this age group. Some pupils will be interested to learn that the United States did not have enough money to buy the Louisiana Territory for $15,000,000 and so had to borrow the money. The interest on this money amounted to over $8,000,000, or more than half the original price of the land. Pupils may be led to realize from this information that borrowing money is costly.

Workbook Reference: Arithmetic Workshop, Book 6, page 27

Key: **2.** 888,811 sq. mi. + 827,192 sq. mi. = 1,716,003 sq. mi. **3.** 1,716,003 + 72,003 + 390,144 + 285,580 + 529,017 + 29,640 = 3,022,387 (sq. mi.). **4.** (1) 827,192 × $18 = $14,889,456, yes; (2) $18.00 ÷ 640 = $.02$\frac{13}{16}$, or about $.03. **5.** $15,000,000 + $5,000,000 + $18,000,000 + $10,000,000 + $10,000,000 = $58,000,000.

Page 178

Aim: To teach the division of fractions and mixed numbers by whole numbers

Suggestions: In this work remind the pupils that when the divisor is a whole number it should first be written in the form of a fraction with 1 as its denominator. For example, 4 should be written as $\frac{4}{1}$, and 3 should be written as $\frac{3}{1}$.

Workbook Reference: Arithmetic Workshop, Book 6, page 71

Key: **3.** $\frac{1}{8}$; $\frac{1}{16}$; $\frac{5}{8}$; $\frac{3}{4}$; $\frac{1}{6}$. **4.** $\frac{1}{6}$; $\frac{1}{10}$; $\frac{1}{2}$; $\frac{3}{8}$; $\frac{3}{8}$. **5.** $\frac{1}{24}$; $\frac{1}{10}$; $\frac{3}{5}$; $\frac{5}{6}$; $\frac{7}{16}$.

Page 179

Aim: To review work in the division of fractions

Workbook Reference: Arithmetic Workshop, Book 6, page 78

Key: **1.** 10 A.M. to 5:30 P.M. is $7\frac{1}{2}$ hr.; $7\frac{1}{2} \div \frac{3}{4} = 10$ (trips). **2.** $3\frac{3}{4}$ hr. $\div 5 = \frac{3}{4}$ hr. **3.** $\frac{1}{4}$ lb. $\div 8 = \frac{1}{32}$ lb. **4.** $4 \div \frac{1}{2} = 8$ (bags). **5.** $2\frac{1}{2} \div \frac{1}{2} = 5$ (lessons). **6.** $\frac{1}{12}$; $4\frac{1}{2}$; $1\frac{1}{2}$; $\frac{3}{40}$; $\frac{3}{5}$. **7.** 6; 24; $\frac{3}{8}$; $\frac{1}{10}$; $7\frac{1}{2}$. **8.** 2; $1\frac{1}{6}$; 15; $\frac{7}{12}$; $\frac{9}{10}$. **9.** $3\frac{1}{2}$; $3\frac{1}{5}$; 4; $4\frac{1}{6}$; $1\frac{2}{3}$. **10.** 8; $\frac{2}{3}$; 40; 20; $\frac{3}{5}$. **11.** 20; $\frac{2}{5}$; $\frac{1}{5}$; 8; 9. **12.** 10; $2\frac{1}{4}$; $6\frac{1}{4}$; $\frac{1}{6}$; 20. **13.** $1\frac{1}{2}$; $2\frac{1}{2}$; $1\frac{3}{4}$; 3; $\frac{2}{5}$. **14.** $\frac{4}{5}$; $\frac{1}{6}$; $9\frac{3}{4}$; $10\frac{1}{2}$; $1\frac{1}{6}$.

Pages 180–181

Aim: To teach division by a mixed number

Suggestions: The pupils will have no difficulty with the work on these pages if they are first reminded that a mixed number must first be changed to an improper fraction before it can be used as a divisor. This fact is emphasized in ex. 3 on page 180.

Workbook Reference: Arithmetic Workshop, Book 6, page 74

Key: Page 180 **2.** 9 hr. = 540 min.; $1\frac{1}{2}$ hr. = 90 min.; $540 \div 90 = 6$ (groups), yes. **3.** $\$1.00 \div 2\frac{1}{2} = \$.40$. **4.** $1\frac{2}{3}$; $3\frac{1}{3}$; 8; \$.40. **5.** $\frac{2}{3}$; $4\frac{1}{2}$; 8; \$.15. **6.** $\frac{1}{4}$; $3\frac{3}{5}$; $\frac{2}{5}$; \$.40. **7.** 6; 10; $1\frac{1}{2}$; \$.40.

Page 181 **1.** 133 mi. $\div 3\frac{1}{2} = 38$ mi. **2.** 14 mi. $\div 3\frac{1}{3} = 4\frac{1}{5}$ mi. **3.** (1) $8\frac{3}{4} \div 3\frac{1}{2} = 2\frac{1}{2}$ (hr.); (2) $14 \div 3\frac{1}{2} = 4$ (hr.). **4.** 1 hr. 40 min. = $1\frac{2}{3}$ hr.; $2\frac{1}{2} \div 1\frac{2}{3} = 1\frac{1}{2}$ (mi.). **5.** $3\frac{1}{3}$; $\frac{1}{9}$; $1\frac{1}{2}$; 4. **6.** $\frac{3}{16}$; $\frac{3}{10}$; $\frac{4}{5}$; $\frac{3}{5}$. **7.** $4\frac{1}{2}$; $\frac{1}{6}$; 24; 4. **8.** $\frac{9}{32}$; $4\frac{1}{2}$; $1\frac{7}{8}$; $\frac{7}{12}$. **9.** 6; $\frac{1}{12}$; $1\frac{1}{3}$; $\frac{1}{4}$.

Page 182

Aim: To review work with decimal fractions

Workbook Reference: Arithmetic Workshop, Book 6, page 77

Key: **1.** .4; .02; .19; .513; .87; .037; .003. **2.** $\frac{1}{25}$; $\frac{3}{10}$; $\frac{1}{125}$; $\frac{93}{200}$; $\frac{29}{1000}$; $\frac{7}{50}$; $\frac{3}{5}$. **3.** 39.382. **4.** 30.22. **5.** 3.91. **6.** 47.3. **7.** 32.375. **8.** 5.6; 4.125; 3.2; 1.48. **9.** 2.8; 2.35; 3.5; .25. **10.** About 8; about 8; about 17. **11.** 1.15; 1.75; 1.384; 2940.0; .056; 2.728. **12.** 11.34; 2.479; .096; 52.38; .456; 242.84. **13.** 2.58; .192; 6.432; 1025.0; 1.225; .098. **14.** .99; 25.42; .812; .538; 34.75; 3.366.

Page 183

Aim: To give a new set of improvement tests on subtraction

Suggestion: This set of improvement tests on subtraction is to be administered in the same way as the preceding tests on subtraction.

Key: **1.** 42,123; 12,789; 8519; 702. **2.** 34,231; 1679; 13,805; 39,741. **3.** 31,282; 16,893; 13,768; 9771. **4.** 25,113; 2947; 12,367; 55,709. **5.** 13,834; 35,001; 4380; 37,876. **6.** 47,955; 71,406; 1508; 6633. **7.** 14,352; 3125; 31,874; 638. **8.** 17,261; 23,307; 13,039; 1793. **9.** 49,961; 811; 16,496; 21,501.

Pages 184–185

Aims: To show how to compare a larger number with a smaller one and to explain how to use such comparisons in problem solving

Suggestions: Numbers are frequently compared by division. You compare a larger number with a smaller one by finding how many times as great the larger number is. The answer is found by dividing the larger number by the smaller one. Comparisons of this kind are made in the exercises on page 184. In this work the pupils should be made familiar with such expressions as "how many times as old," "how many times as great," and so on. Numbers can be compared also by subtraction. For example, you may compare 95 with 80 by finding that 95 is 15 more than 80. The work on page 184, however, is limited to comparisons that are made by division.

On page 185, the work in comparing numbers by division is used as an aid in solving problems.

Workbook Reference: Arithmetic Workshop, Book 6, page 75

Key: Page 184 **1.** 3 times. **2.** 12 times. **3.** 2 times. **4.** 123 times. **5.** 26 times. **6.** $18\frac{1}{4}$ times. **7.** 25. **8.** 6. **9.** 640. **10.** 8. **11.** 6. **12.** 600.

Page 185 **1.** \$1.47. **2.** 84 ÷ 2 = 42 (times); 42 × 7¢ = 294¢ or \$2.94. **3.** 30 ÷ 12 = $2\frac{1}{2}$ (times); $2\frac{1}{2}$ × \$.29 = \$.72$\frac{1}{2}$, or \$.73. **4.** 180 ÷ 36 = 5 (times); 5 × 2 eggs = 10 eggs. **5.** 5 × 2 oz. = 10 oz.

Pages 186–187

Aims: To show how to compare a smaller number with a larger one and to apply this work in problem solving

Suggestions: A smaller number is compared with a larger one by asking this question: "The smaller number is what part of the larger one?" This type of comparison is made by writing the smaller number over the larger one to form a fraction and then changing the fraction to lowest terms. For example, to compare 3 with 15, write 3 over 15 to form the fraction $\frac{3}{15}$, which changes to $\frac{1}{5}$. Hence, 3 is $\frac{1}{5}$ of 15. In some of the exercises on page 187, the work on page 185 is reviewed.

Key: **2.** $\frac{24}{96} = \frac{1}{4}$. **3.** 16 + 24 = 40 (pots); 96 − 40 = 56 (pots); $\frac{56}{96} = \frac{7}{12}$. **4.** (1) $\frac{6}{12} = \frac{1}{2}$, $\frac{1}{2}$ × \$4.00 = \$2.00; (2) $\frac{9}{12} = \frac{3}{4}$, $\frac{3}{4}$ × \$4.00 = \$3.00; (3) $\frac{8}{12} = \frac{2}{3}$, $\frac{2}{3}$ × \$4.00 = \$2.66$\frac{2}{3}$, or \$2.67. **5.** (1) $\frac{10}{25} = \frac{2}{5}$, $\frac{2}{5}$ × \$4.50 = \$1.80; (2) 50 ÷ 25 = 2 (times), 2 × \$4.50 = \$9.00. **6.** (1) 600 − 25 = 575 (plants); (2) $\frac{575}{600} = \frac{23}{24}$; (3) $\frac{25}{600} = \frac{1}{24}$. **7.** 12 × 12 = 144 (snapdragons). **8.** 144 ÷ 6 = 24 (times); 24 × 76¢ = 1824¢ or \$18.24. **9.** (1) 4 ÷ 2 = 2 (times), 2 × 95¢ = 190¢ or \$1.90; (2) 6 ÷ 2 = 3 (times), 3 × 95¢ = 285¢ or \$2.85. **10.** (1) $\frac{2}{10} = \frac{1}{5}$, $\frac{1}{5}$ × \$11.50 = \$2.30; (2) $\frac{5}{10} = \frac{1}{2}$, $\frac{1}{2}$ × \$11.50 = \$5.75; (3) 25 ÷ 10 = $2\frac{1}{2}$ (times), $2\frac{1}{2}$ × \$11.50 = \$28.75. **11.** (1) $\frac{15}{60} = \frac{1}{4}$ (hr.); (2) $\frac{45}{60} = \frac{3}{4}$ (hr.). **12.** $\frac{10}{20} = \frac{1}{2}$ (mi.).

Page 188

Aim: To show how to find the whole when a part of it is given

Suggestion: The methods of finding the whole when a part of it is given are illustrated in ex. 1 and 2.

Key: **3.** 3 × \$2.75 = \$8.25. **4.** 4 × \$12.50 = \$50.00. **5.** $\frac{1}{3}$ × 45¢ = 15¢; 4 × 15¢ = 60¢. **6.** $\frac{1}{2}$ × \$28.40 = \$14.20; 3 × \$14.20 = \$42.60. **7.** 25; 160; 72 **8.** 27; 30; 240. **9.** 9; 48; 66. **10.** 12; 56; 120. **11.** 24; 90; 72.

Page 189

Aim: To review previous work

Key: **1.** $10\frac{1}{3}$; $12\frac{1}{4}$. **2.** \$9.01; $3\frac{5}{6}$. **3.** 20; 409.355. **4.** 16; 33 R48. **5.** 6728. **6.** 48 + 81 + 35 + 69 + 56 + 17 = 306; 306 ÷ 6 = 51. **7.** $294\frac{3}{8}$. **8.** (1) 285 ÷ 15 = 19; (2) 18 ÷ $\frac{1}{2}$ = 36; (3) $10\frac{1}{2} \div 1\frac{1}{2} = 7$. **9.** (1) $\frac{9}{12} = \frac{3}{4}$; (2) $\frac{28}{56} = \frac{1}{2}$. **10.** (1) 72 ÷ $\frac{1}{2}$ = 144; (2) 24 ÷ $\frac{2}{3}$ = 36; (3) 100 ÷ $\frac{5}{8}$ = 160. **11.** 2; $1\frac{1}{2}$. **12.** $3\frac{1}{10} + 2\frac{1}{2} + 4\frac{1}{5} = 9\frac{4}{5}$; $15 - 9\frac{4}{5} = 5\frac{1}{5}$. **13.** 2000; 3000; 6000; 8000; 8000. **14.** 200; 400; 900; 900; 1500; 4700; 7000. **15.** .250; 2.50; 25.0. **16.** .144. **17.** \$10.71. **18.** 24.89.

Page 190

Aim: To present problems containing extra facts

Suggestions: One of the characteristics of real-life problems is that there are usually many more facts than are actually needed for a logical answer. It is therefore necessary to decide which facts are pertinent and which are extra. These problems provide the pupil with an excellent opportunity to think discriminately about word problems and to select the facts which are necessary to solve the problem at hand. Encourage pupils to discuss the manner in which they selected the necessary facts, and to explain why the other facts are unnecessary.

Workbook Reference: Arithmetic Workshop, Book 6, page 82

Key: **1.** "16 mi." not needed; 75 ÷ 30 = $2\frac{1}{2}$ (hr.). **2.** "34 yr." not needed; 6 handkerchiefs are three times as many as 2 handkerchiefs, 3 × \$.75 = \$2.25. **3.** "10 fish" not needed; 3 × 45¢ = 135¢, 135¢ ÷ 3 = 45¢. **4.** "50 yd." and "100 yd." not needed; 3 × 5¢ = 15¢, 2 × 9¢ = 18¢, 15¢ + 18¢ = 33¢. **5.** "75¢" not needed; (1) $1\frac{1}{2}$ × 52¢ = 78¢; (2) $2\frac{1}{2}$ × 52¢ = 130¢ or \$1.30. **6.** "3 mi." not needed; $6\frac{1}{2}$ mi. ÷ 2 = $3\frac{1}{4}$ mi. **7.** "25¢" and "35¢" not needed; 6 ÷ 3 = 2, 2 × 10¢ = 20¢. **8.** "50 sheets" not needed; 29¢ + 20¢ = 49¢ or \$.49, \$1.00 − \$.49 = \$.51.

Page 191

Aim: To review some of the common measures

Suggestion: This review page on measures requires also ability in finding a fractional part of a number.

Key: **1.** 30 in. + 40 in. + 30 in. + 40 in. + 4 in. = 144 in.; 144 in. ÷ 36 in. = 4 (yd.). **2.** 45 min. = $\frac{3}{4}$ hr.; $\frac{3}{4}$ hr. costs \$2.25, so $\frac{1}{4}$ hr. costs $\frac{1}{3}$ × \$2.25, or \$.75. A whole hour costs 4 × \$.75, or \$3.00. **3.** 2 bu. = 64 qt.; 64 ÷ 2 = 32 (baskets); 32 × 35¢ = 1120¢ or \$11.20. **4.** (1) $\frac{8}{16} = \frac{1}{2}$ (lb.); (2) $\frac{14}{16} = \frac{7}{8}$ (lb.); (3) $\frac{12}{16} = \frac{3}{4}$ (lb.). **5.** 4 lb. 12 oz. = $4\frac{3}{4}$ lb.; $4\frac{3}{4}$ × \$.56 = \$2.66. **6.** 12 ft. × 12 ft. = 144 sq. ft., 15 ft. × 9 ft. = 135 sq. ft., 144 sq. ft. − 135 sq. ft. = 9 sq. ft.; so the square is larger by 9 sq. ft. **7.** $3\frac{1}{2}$ lb. = 56 oz., 56 ÷ 8 = 7 (boxes); no. **8.** (1) 1 lb. = 16 oz., 16 oz. ÷ $1\frac{3}{4}$ oz. = $9\frac{1}{7}$ (bars), or 9 bars to the nearest whole bar; (2) a little less than a pound; (3) 9 × 5¢ = 45¢. **9.** 3600; 5; 135. **10.** 6; 4; 14. **11.** $13\frac{1}{2}$; $3\frac{1}{3}$; 20. **12.** 15; 51; 105. **13.** 4; $\frac{7}{8}$; $1\frac{1}{2}$. **14.** 3960; $2\frac{1}{4}$; 2. **15.** 27; 6600; $3\frac{1}{2}$. **16.** 8; 54; $\frac{5}{6}$.

Page 192

Aim: To review the addition and subtraction of decimal fractions

Workbook Reference: Arithmetic Workshop, Book 6, page 77

Key: **1.** $971.54; $662.79; $1288.57; $1228.51. **2.** $1777.03; $1300.08; $929.79; $885.75. **3.** 297.3. **4.** 2.542. **5.** 41.344. **6.** $42.91; $42.71; $399.77; $10.18. **7.** $5.87; $33.19; $567.63; $265.84. **8.** $.26; $10.15; $.76; $2.19. **9.** $26.19; $18.93; $13.75; $79.81. **10.** 5.4; 27.4; $3.54; $8.02. **11.** 3.8; 57.3; $4.03; $21.51.

Page 193

Aim: To give a true-false test

Suggestions: Suggest to the pupils that the scoring on this test will be different from that usually found on a regular test. The number of incorrect answers will be subtracted from the number of correct answers. This scoring scheme discourages guessing and pays a premium to the pupil who knows the work.

Key: **1.** Yes. **2.** Yes. **3.** No; it stands for 1959. **4.** No; it becomes $\frac{1}{3}$. **5.** Yes. **6.** No; it is 12. **7.** No; $6\frac{2}{3}$ is a mixed number and 4.5 is a mixed decimal. **8.** Yes. **9.** Yes. **10.** Yes. **11.** No; the product is .63. **12.** No; the cost is 64¢. **13.** Yes. **14.** Yes. **15.** No; 18 ÷ 72 = $\frac{18}{72}$ = $\frac{1}{4}$. **16.** Yes. **17.** No; 12 lb. ÷ $2\frac{1}{2}$ lb. = $4\frac{4}{5}$ (times). **18.** Yes. **19.** No; you divide by 6.

Page 194

Aim: To review the major aims of Chapter 5

Suggestions: This test reviews 4 of the 6 major aims of Chapter 5 as listed in this Guide at the beginning of the chapter. Specifically, these are:

Chapter Review	*Aim Number*
Ex. 1, 3, 4, 5	5
Ex. 2 and 6	6
Ex. 7–13	4
Ex. 14–16	3

Key: **1.** $\frac{9}{24}$ = $\frac{3}{8}$ (da.). **2.** 4 × 15¢ = 60¢. **3.** 30 ÷ 6 = 5, 5 × 25¢ = 125¢ or $1.25. **4.** (1) $\frac{4}{12}$ = $\frac{1}{3}$, $\frac{1}{3}$ × $4.50 = $1.50; (2) $\frac{6}{12}$ = $\frac{1}{2}$, $\frac{1}{2}$ × $4.50 = $2.25. **5.** 8000 ÷ 250 = 32 (times). **6.** $\frac{1}{3}$ × $27.30 = $9.10; 4 × $9.10 = $36.40. **7.** 12; 7; $6\frac{2}{3}$; $\frac{1}{8}$. **8.** $\frac{2}{5}$; $\frac{5}{12}$; 4; $\frac{1}{5}$. **9.** $1\frac{7}{8}$; 36; $2\frac{2}{5}$; $\frac{1}{25}$. **10.** $2\frac{1}{2}$; $\frac{3}{8}$; $\frac{5}{8}$; $2\frac{1}{2}$. **11.** $\frac{1}{12}$; 9; $1\frac{1}{2}$; $\frac{9}{16}$. **12.** 8; $2\frac{3}{4}$; $\frac{1}{10}$; $\frac{3}{8}$. **13.** 20; 2; $\frac{1}{6}$; $\frac{1}{4}$. **14.** 47; $29\frac{1}{27}$; 427; $294\frac{1}{2}$. **15.** 26; 40; $308\frac{1}{4}$; 480. **16.** 45; $68\frac{10}{237}$; 37; 467.

Page 195

Aim: To present Problem Test 5

Suggestions: Be sure that the pupils graph their scores as suggested in this Guide for Problem Test 1, page 41.

Workbook Reference: Arithmetic Workshop, Book 6, page 72

Key: **1.** $3\frac{1}{2} \times \$1.45 = \$5.07\frac{1}{2}$ or \$5.08; $\$10.00 - \$5.08 = \$4.92$. **2.** $\frac{6}{8} = \frac{3}{4}$ (hr.). **3.** $266 \div 38 = 9$ (times). **4.** $\frac{15}{36} = \frac{5}{12}$. **5.** $19¢ \div 4 = 4\frac{3}{4}¢$. **6.** $4\frac{1}{2}$ doz. + 5 doz. + $6\frac{1}{4}$ doz. + $4\frac{1}{4}$ doz. = 20 doz.; 20 doz. ÷ 4 = 5 doz. **7.** $78¢ \div 1\frac{1}{2} = 52¢$. **8.** $18 \div 6 = 3$ (times); 3×4 cups = 12 cups. **9.** $4\frac{1}{4}$ yd. − $3\frac{3}{4}$ yd. = $\frac{1}{2}$ yd. **10.** $18 \times 4\frac{1}{2}$ yd. = 81 yd.; $81 \times 79¢ = 6399¢$ or \$63.99.

Page 196

Aim: To present a diagnostic test with page references for remedial work

Key: **1.** 52; 41 R77; 35. **2.** 67; 84 R81 or $84\frac{1}{3}$; 59. **3.** 46 R64 or $46\frac{2}{3}$; 852; 235 R135 or $235\frac{1}{5}$. **4.** 680; 304; 6005. **5.** 32; 18; $12\frac{1}{2}$. **6.** 2; $2\frac{1}{4}$; $1\frac{1}{2}$. **7.** 6; $1\frac{3}{4}$; $6\frac{1}{4}$. **8.** $\frac{5}{24}$; $\frac{3}{10}$; $\frac{1}{10}$. **9.** $\frac{1}{4}$; $\frac{3}{5}$; $\frac{1}{4}$. **10.** $1\frac{2}{3}$; $5\frac{1}{3}$; $2\frac{2}{5}$. **11.** 3; 3; $2\frac{7}{16}$. **12.** $\frac{1}{8}$; $\frac{3}{16}$; $\frac{3}{20}$. **13.** 20; 12; 60. **14.** 12; 10; 40. **15.** 6. **16.** $\frac{1}{3}$; $\frac{1}{10}$; $\frac{8}{9}$. **17.** $\frac{1}{4}$; $\frac{1}{12}$; $\frac{5}{6}$.

Chapter 6

Aims of Chapter 6. The major aims of Chapter 6 are to:

1. Review understandings and skills taught in previous chapters.
2. Teach division of decimal fractions and mixed decimals by whole numbers.
3. Teach pupils how to avoid remainders by annexing zeros to the dividend.
4. Show how to round off decimal fractions.
5. Show how to change common fractions to decimal fractions.
6. Teach the reading and making of line graphs.
7. Teach multiplication and division by 10, 100, and 1000.
8. Review measures of weight.
9. Teach how to divide by decimal fractions and mixed decimals.
10. Estimate answers to examples involving decimal fractions.

Pages 197–198

Aim: To present problems dealing with averages centered around a unit on homing pigeons

Suggestions: The data used in these problems are authentic and should develop an interest in homing pigeons and the sending of messages. Some pupils may wish to conduct special research reports on other interesting facts connected with raising, training, and using homing pigeons. The arithmetic in these problems involves time-rate-distance applications.

Key: Page 197 **1.** 60 × 1 mi. = 60 mi. **2.** 280 mi. ÷ 5 = 56 mi. **3.** 500 mi. ÷ $6\frac{2}{3}$ = 75 mi.

Page 198 **1.** 260 mi. ÷ $3\frac{1}{4}$ = 80 mi. **2.** 260 mi. ÷ 30 = $8\frac{2}{3}$ mi. **3.** 80 ÷ $8\frac{2}{3}$ = $9\frac{3}{13}$ (times), or about 9 times. **4.** 1260 mi. ÷ 5 = 252 mi. **5.** 735 mi. ÷ $17\frac{1}{2}$ = 42 mi. **6.** 80 ÷ 32 = $2\frac{1}{2}$ (times). **7.** $1\frac{1}{4}$ × 1760 yd. = 2200 yd. **8.** $1\frac{1}{2}$ × 1760 yd. = 2640 yd., $1\frac{3}{4}$ × 1760 yd. = 3080 yd.; so $1\frac{3}{4}$ mi. per minute is closer.

Page 199

Aim: To present two more sets of improvement tests in multiplication and division

Suggestion: These improvement tests should be given in the same manner as the preceding improvement tests in multiplication and division.

Key: **1.** 498,825; 94,128; 412,896; 213,408; 249,951; 205,800. **2.** 191,952; 53,658; 494,375; 314,611; 533,565; 261,900. **3.** 229,772; 609,169; 313,239; 320,496; 931,884; 178,560. **4.** 417; 625; 856 R11. **5.** 296 R9; 487; 867. **6.** 485; 362; 539. **7.** 986 R5; 714; 627 R13. **8.** 684; 925; 376 R7. **9.** 549; 863 R10; 719.

Page 200

Aim: To divide decimals, other than dollars and cents, by whole numbers when the quotients are exact decimals

Suggestion: In this work, caution the pupils to write the first quotient figure in the right position over the dividend.

Workbook Reference: Arithmetic Workshop, Book 6, page 83

Key: **4.** 3.2; .151; .73; .319; 2.19. **5.** .12; 14.5; .229; 9.8; 8.3. **6.** .9; .119; .249; 2.24; .326. **7.** .17; .32; 1.18; 7.3; .57. **8.** 2.4; 5.4; 7.2; 8.7; .294. **9.** .13; .75; .137; 7.9; 14.7.

Pages 201–203

Aim: To teach how to avoid remainders in division by carrying the quotient to more decimal places

Suggestions: This work is fully explained on pages 201 and 202. The exercises on these pages are such that the division will come out exact if enough zeros are annexed after the dividend. In connection with this work, make clear to the pupils what is meant by annexing zeros after the dividend.

Workbook Reference: Arithmetic Workshop, Book 6, page 84

Key: Page 202 **2.** $38\frac{1}{4}$ mi.; 38.25 mi. **3.** $4\frac{3}{4}$ tons; 4.75 tons. **4.** \$3.87$\frac{1}{2}$; \$3.875. **5.** $4\frac{1}{4}$ mi.; 4.25 mi. **6.** $5\frac{3}{4}$ mi.; 5.75 mi. **7.** \$1.87$\frac{1}{2}$; \$1.875. **8.** \$1.52$\frac{1}{2}$; \$1.525. Page 203 **1.** 4.25; 8.5; 8.25; 9.44; 11.25. **2.** 2.5; 9.2; 6.5; 5.5; 6.28. **3.** 6.75; 6.25; 2.5; 8.5; 10.6. **4.** 13.5; 7.4; 1.75; 7.625; 7.5. **5.** 4.125; 8.25; 5.24; 6.125; 4.36. **6.** 9.25; 9.75; 10.25; 7.25; 6.8. **8.** \$.98; \$.75. **9.** .5; .76; .625; .48; 1.35. **10.** .6; .125; .68; .375; 1.175. **11.** .625; .5; .25; .84; 1.22. **12.** .875; .52; .75; .775; 1.476.

Page 204

Aim: To present a completion test involving special vocabulary and understandings

Key: **1.** Invert. **2.** Numerators; denominators. **3.** Invert; multiply. **4.** Tenths; hundredths; thousandths. **5.** Divisible; divisible. **6.** Length; width. **7.** Square foot; square yard; acre. **8.** Multiplier; multiplicand. **9.** Same sum. **10.** Smaller; larger; fraction. **11.** Divide; larger; smaller. **12.** Decimal; mixed decimal. **13.** Dimensions; same. **14.** Rounded off; million.

Page 205

Aim: To present problems dealing with the raising of corn

Suggestions: Pupils in the Midwest will have a fine background for understanding these word problems, but in other locations you will need to refer to a geography or to farm experiences of the pupils before allowing the class to undertake these problems. Such expressions as *yield of an acre* and *10-acre yield of 1803.0 bushels* are meaningless to children who are used to buying canned or frozen corn at the grocery store or possibly a dozen ears of corn during the summer season.

Key: **1.** 1734 bu.; 3797.46 bu.; 2479.62 bu. **2.** 172.7 bu.; 170.4 bu.; 164.3 bu.; 160.72 bu. **3.** 180.3 bu.; 161.46 bu.; 159.32 bu.; 142.79 bu. **4.** 104.2 bu.; 4949.5 bu. **5.** 112.6 bu.; \$928.95; \$1013.40.

Page 206

Aim: To present problems without questions

Suggestions: A similar set of problems is found on page 39. This material is a very valuable type of problem-solving activity since it emphasizes an essential element in every problem; namely, that the problem must ask a question. Naturally, different pupils will suggest different questions for a given problem, but every sensible question should be accepted.

Pages 207–208

Aims: To teach the rule for rounding off decimals and to apply it in rounding off quotients in division and in problem solving

Suggestions: The method of rounding off decimals is fully explained on page 207. This page should be very carefully studied since it leads up to the rule for rounding off decimals, which is given at the bottom of the page. In this work the pupils must fully understand such expressions as "round off to the nearest tenth" and "round off to the nearest hundredth." The explanation in ex. 1 on page 208 should also have careful attention. Before concluding the class discussion on these pages, be sure to refer the pupils to page 27, which dealt with rounding off numbers in general.

Workbook Reference: Arithmetic Workshop, Book 6, pages 85 and 86

Key:

Page 208 **2.** 4.7; .5; 7.3; 4.9; 2.1; 9.0; .7; 3.5; 3.0. **3.** 5.28; 7.92; 3.22; .91; 6.39; 8.40; .30. **4.** 5.3; 9.6; .3; 4.2; .4; .8. **5.** 3.2; 8.8; 9.7; 8.4; .2; .2. **6.** 7.2; 7.7; 1.4; 6.8; .3; .2. **7.** 19.3; 9.8; .5; 3.8; .7; .8. **8.** 8.17; 5.56; .15; .12; 1.44; 1.49. **9.** 1.86; 2.88; .10; .18; .17; .12. **10.** 7.67; 14.17; .14; .33; .68; .76. **11.** 3.63; 8.43; .12; .87; .11; .15. **12.** 11.83; 27.33; .04; .47; .31; .30.

Page 209

Aim: To review finding the average (arithmetic mean) when decimal fractions are involved

Suggestions: The determination of average costs for operating an automobile is a common activity in many homes. Every automobile owner should know what his costs are and thus be guided in his selection of autos and his wise use of them. Every automobile is costly to run — from 3¢ to 15¢ a mile. In problem 2, the pupil determines the gasoline cost of driving a car 7875 miles, whereas in problem 1 the average gasoline mileage is determined. Pupils may be led into an interesting discussion of gasoline mileage costs in automatic transmission cars versus standard transmission cars. Also, it should be emphasized that the cost of gasoline is usually the *smallest* cost in car ownership. Other costs, such as oil, grease, repairs, tires, antifreeze, garage, and insurance, exceed gasoline costs; and the cost of depreciation usually exceeds all of those costs. If some pupils appear interested in these problems, allow them to keep a notebook in which an account of their own family car costs might be recorded.

Workbook Reference: Arithmetic Workshop, Book 6, page 87

Key: **1.** 7875 mi. ÷ 512 = 15.38 mi., or 15.4 mi. **2.** $136.19 ÷ 512 = $.265, or $.27. **3.** 268 mi. ÷ 35 mi. = 7.65, or 7.7 (hr.). **4.** 334 mi. ÷ 8 = 41.75, or 41.8 (mi.). **5.** 1973 mi. ÷ 7 = 281.8 mi., or 282 mi.

Pages 210–211

Aim: To show how to change common fractions to exact decimals or incomplete decimals

Suggestions: The work on page 210 shows how to change a common fraction to an exact decimal. This work is explained in ex. 1 and 2. In the box at the bottom of the page, eight fractions and their decimal equivalents are given; these equivalents are frequently used in subsequent work and should be memorized. The work on page 211 shows how to change a common fraction to an incomplete decimal. The explanations of this work, which are given in ex. 1 and 4, should be studied carefully. In the box in the middle of this page, four common fractions and their decimal equivalents are given; since these are frequently used, they should be memorized. You may explain to the pupils that there is another way to write this type of decimal fraction: add a plus sign instead of writing the common fraction. In this way the answer is purely a decimal fraction and the plus sign indicates that further computation is necessary before an exact answer is possible. In fact, some decimal fractions become repeating fractions and never end. For instance, $\frac{1}{3} = .33333333333\frac{1}{3}$ and will never terminate. Mathematicians use the plus sign far more frequently than the common fraction to indicate that a remainder still exists.

Workbook Reference: Arithmetic Workshop, Book 6, page 88

Key: Page 210 **3.** .2; .75; .5; .8; .45; .7; .32; .15; .4; .68; .3. **4.** .125; .375; .875; .6; .65; .16; .9; .85; .625; .55; .36. **5.** .394; $\frac{3}{5}$; .32; $\frac{24}{25}$; $\frac{9}{20}$. **6.** $\frac{3}{4}$; $\frac{7}{8}$; $\frac{4}{25}$; .43; $\frac{13}{25}$. Page 211 **2.** .33; .83; .14; .44; .85; .16; .22; .88; .41; .27; .73. **5.** .83; .43; .11; .33; .36; .71; .56; .69; .58; .24; .58. **6.** 8.67; 1.86; 5.89; 7.57; 3.33; 4.17; 2.14; 4.29; 6.44; 8.83.

Page 212

Aim: To present problems involving mixed decimal numbers

Suggestions: Mixed decimal numbers are often used. Notice the variety of situations discussed in these problems: the average height of a story, average mileage, average speed per hour, and average rainfall or snowfall.

Key: **1.** 850 ft. ÷ 70 = 12.14 ft., or 12.1 ft. **2.** 1205 mi. ÷ 37 = 32.56 mi., or 32.6 mi. **3.** 3173 mi. ÷ 35 mi. = 90.65, or 90.7 (hr.). **4.** 1162 mi. ÷ 235 mi. = 4.94, or 4.9 (hr.). **5.** 9.8 in. + 9.9 in. + 9.6 in. + 9.7 in. + 9.9 in. = 48.9 in.; 48.9 in. ÷ 5 = 9.78 in., or 9.8 in. **6.** 7.5 in. + 8.4 in. + 11.3 in. + 9.3 in. = 36.5 in.; 36.5 in. ÷ 4 = 9.12 in., or 9.1 in. **7.** 3.72 in. + 4.84 in. + 6.19 in. + 5.72 in. = 20.47 in.; 20.47 in. ÷ 4 = 5.117 in., or 5.12 in. **8.** 52.71 in. ÷ 12 = 4.392 in., or 4.39 in. **9.** 1.338 mi., or 1.34 mi.

Page 213

Aims: To present another set of improvement tests in addition and to give some review of decimal and common fractions

Suggestions: The method of administering this set of improvement tests has already been explained in connection with the previous improvement tests in addition. See page 328 of the text.

Key: **1.** 28,162; 28,154; 32,847; 30,075; 32,668. **2.** 29,155; 30,000; 35,410; 30,036; 26,427. **3.** 27,037; 42,860; 29,930; 28,541; 37,630. **4.** 13.8; .450; .054; 276.0; 8.28. **5.** .24; 46.2; 8.56; .29; 6.84. **6.** 6; $7\frac{1}{3}$; $2\frac{1}{3}$; $\frac{5}{8}$; 1. **7.** $5\frac{1}{3}$; 16; $\frac{3}{5}$; 5; $\frac{3}{4}$. **8.** 20; $13\frac{1}{3}$; $1\frac{1}{5}$; 6; 10.

Pages 214–215

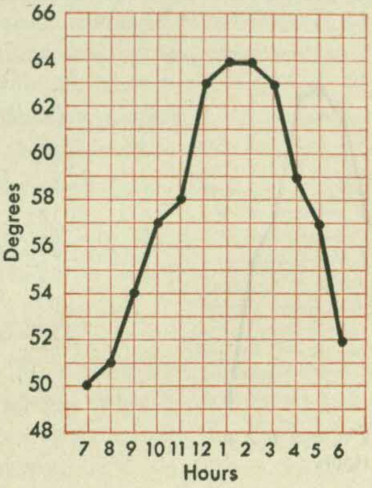
Aim: To teach the making and drawing of line graphs

Suggestions: In this work on line graphs, supply the pupils with squared paper on which they can draw the line graphs mentioned in certain exercises on these pages. If the school does not have a supply of squared paper, a pad of such paper may be purchased, and a few sheets can be distributed to each pupil. Comparisons should be made between the line graphs on these pages and the line graph being completed by every pupil as a scoring method for the improvement tests. Point out that bar graphs also could be made of these data.

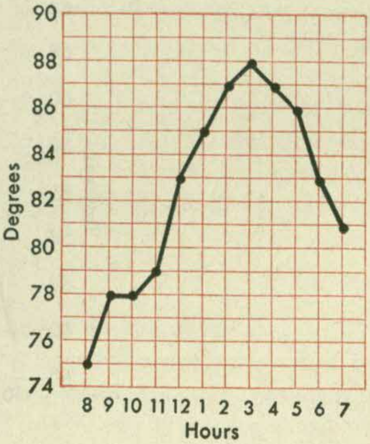
Workbook Reference: Arithmetic Workshop, Book 6, pages 90 and 91

Key: Page 214 **2.** 9 A.M., 35°; 10 A.M., 36°; 11 A.M., 38°; 12 M., 39°; 1 P.M., 38°; 2 P.M., 37°; 3 P.M., 35°; 4 P.M., 33°. **3.** 12 M.; 7 A.M.

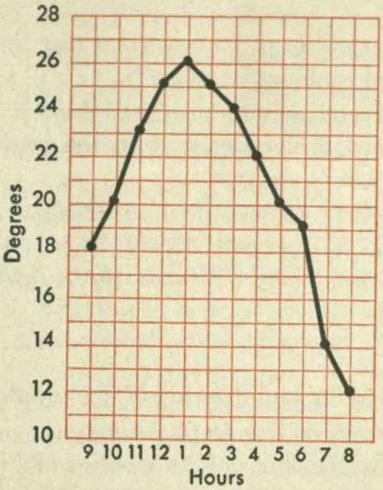
4.



5.



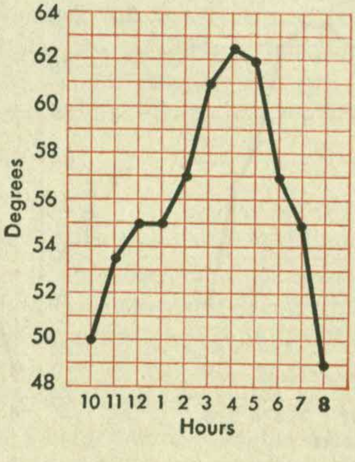
6.



7. (Ex. 4) Highest, 1 P.M. and 2 P.M.; lowest, 7 A.M.; (Ex. 5) highest, 3 P.M.; lowest, 8 A.M.; (Ex. 6) highest, 1 P.M.; lowest, 8 P.M. In ex. 4, the temperature remained the same between 1 P.M. and 2 P.M. In ex. 5, the temperature remained the same between 9 A.M. and 10 A.M. In ex. 6, the temperature was 20° at 10 A.M. and 5 P.M.

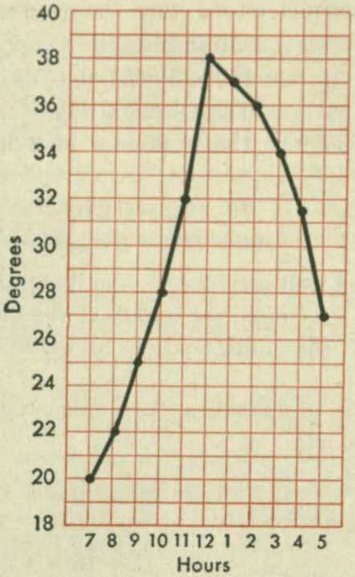
Page 215 **1.** 72°; 74°; 77°; 78°; 78°; 77°; 75°; 74°. **2.** $75\frac{1}{2}^\circ$. **3.** Highest temperatures, 78° between 4 P.M. and 5 P.M.; lowest temperature, 72° at 12 M. **4.** Halfway between 12 M. and 1 P.M.; 73°; $77\frac{1}{2}^\circ$; 78°; 76°; $74\frac{1}{2}^\circ$.

5.



12:30, 55°; 1:30, 56°; 6:30, 56°.

6.



(a) 11:30 A.M. and 2:30 P.M.; (b) 21°, 30°; (c) 8:30 A.M., 9:30 A.M.

Page 216

Aim: To review the four fundamental operations with respect to common fractions

Suggestions: All the process steps taught for common fractions are reviewed on this page: adding and subtracting like fractions, adding and subtracting related fractions, adding and subtracting where least common denominators must be determined, carrying in addition and regrouping in subtraction, multiplication and division in which cancellation occurs.

Key: **1.** 8 ft. − $2\frac{1}{2}$ ft. = $5\frac{1}{2}$ ft. **2.** $1\frac{3}{4} \times 56$¢ = 98¢. **3.** 15 lb. ÷ $\frac{5}{8}$ lb. = 24 (boxes). **4.** $3\frac{1}{2} \times \$.28 = \$.98$; $2\frac{3}{4} \times \$.88 = \$2.42$; $\$.98 + \$2.42 = \$3.40$. **6.** $8\frac{1}{4}$; 9; $4\frac{2}{5}$; $5\frac{1}{4}$; $12\frac{1}{6}$; $6\frac{1}{12}$; $5\frac{1}{2}$; $11\frac{1}{2}$. **7.** 10; $7\frac{2}{5}$; $6\frac{1}{4}$; $7\frac{5}{6}$; $10\frac{1}{8}$; $7\frac{2}{3}$; 13; $11\frac{7}{8}$. **8.** $\frac{1}{3}$; $1\frac{1}{2}$; $5\frac{1}{5}$; $\frac{1}{3}$; $4\frac{1}{4}$; $1\frac{5}{6}$; $\frac{1}{12}$; $1\frac{5}{8}$. **9.** $1\frac{5}{6}$; $1\frac{5}{6}$; $1\frac{1}{2}$; $6\frac{3}{8}$; $2\frac{5}{8}$; $\frac{5}{16}$; $3\frac{1}{2}$; $3\frac{1}{3}$. **10.** 8; $2\frac{2}{5}$; $1\frac{1}{2}$; $\frac{3}{4}$; $5\frac{1}{4}$. **11.** $5\frac{5}{8}$; $\frac{3}{8}$; $\frac{5}{16}$; 14; $\frac{2}{3}$.

Pages 217–218

Aim: To teach multiplication and division by 10, 100, and 1000

Suggestions: Some pupils may need to review the true meaning of place value before beginning with the illustrative examples on page 217. For instance, they might say, "5 × 10 is 5 tens, which equals 50" or "5 × 100 is 5 hundreds, which equals 500." Other pupils may like to use a moving arrow to illustrate their thought processes:

$$5 \times 10 = 5\underset{\curvearrowleft}{0}$$
$$5 \times 100 = 5\underset{\curvearrowleft}{00}$$

When these concepts are understood, then the reverses can be taught:

$$10 \times 5 = 5\underbrace{0}$$
$$100 \times 5 = 5\underbrace{0\,0}$$
$$1000 \times 5 = 5\underbrace{0\,0\,0}$$

The next step would be the treatment of 2-figure and 3-figure numbers, such as:

$$10 \times 52 = 5\,2\underbrace{0}$$
$$100 \times 583 = 5\,8\,3\underbrace{0\,0}$$

After the rule has been well established, the illustrations at the top of the page may be discussed and the rule in the middle of the page emphasized. Beginning with ex. 2 on page 217, the multiplications all involve mixed decimals or decimal fractions.

When page 218 is discussed, a beginning step might be to divide whole numbers by 10 — such as

$$\begin{array}{r} 8 \\ 10\overline{)80} \end{array} \quad \text{OR} \quad 80 \div 10 = 8$$
$$\begin{array}{r} 4.7 \\ 10\overline{)47.0} \end{array} \quad \text{OR} \quad 47 \div 10 = 4.7$$

Some pupils may point out that since division is the inverse operation of multiplication, naturally you would move the decimal point in the opposite direction, to the left.

The practice exercises beginning with ex. 4 on page 218 involve decimal fractions and mixed decimals.

All the work on these two pages is in readiness for the teaching of division by decimal fractions.

Workbook Reference: Arithmetic Workshop, Book 6, page 92

Key: Page 217 **2.** \$27.50, \$2.75, \$341.20, \$4420, 2, .9, 73; \$275, \$27.50, \$3412, \$44,200, 20, 9, 730; \$2750, \$275, \$34,120, \$442,000, 200, 90, 7300. **3.** \$93.50, \$1.93, \$127.90, \$3040, 7, .3, 17; \$935, \$19.30, \$1279, \$30,400, 70, 3, 170; \$9350, \$193, \$12,790, \$304,000, 700, 30, 1700. **4.** \$59.10, \$2.69, \$299.80, \$7200, 4, .5, 49; \$591, \$26.90, \$2998, \$72,000, 40, 5, 490; \$5910, \$269, \$29,980, \$720,000, 400, 50, 4900. **5.** \$2.48. **6.** \$250. **7.** \$256. **8.** \$35.

Page 218 **4.** \$3.45, \$.70, \$21.70, 3.9, .41, 2.37, 64.8; \$.345, \$.07, \$2.17, .39, .041, .237, 6.48. **5.** \$1.90, \$.45, \$79.20, 7.2, .79, 5.74, 31.9; \$.19, \$.045, \$7.92, .72, .079, .574, 3.19. **6.** \$.25; \$.004; \$1.27; .007; .018; 3.692; .906. **7.** \$.745; \$.03; \$3.50; .001; .057; 7.415; .537.

Page 219

Aim: To review measures of weight

Key: **2.** $\frac{3}{4}$ lb.; $\frac{1}{4}$ lb.; $\frac{7}{8}$ lb. **3.** $\frac{1}{4}$ T.; $\frac{1}{10}$ T.; $\frac{3}{5}$ T. **5.** 2 T. = 4000 lb., 4000 lb. ÷ 125 lb. = 32 (boxes). **6.** \$8.37. **7.** 1.5 × \$4.82 = \$7.23. **8.** 48 × \$14.50 = \$696.00. **9.** 10,000 lb. **10.** 54; $\frac{1}{4}$; $\frac{1}{2}$. **11.** 114; $1\frac{1}{2}$; $\frac{3}{8}$. **12.** 18; 4; $\frac{7}{8}$.

Page 220

Aims: To explain a fundamental principle that is used in the division of decimals and to show how to divide a decimal by a decimal

Suggestions: In ex. 1 an important principle is given. It states that both the divisor and the dividend may be multiplied by 10, 100, 1000, and so on, *without changing the value* of the quotient. This principle is fully explained in ex. 1 and rests on the broader principle of numbers that if the numerator and the denominator of a fraction are multiplied by the same number, the value of the fraction remains unchanged.

Any exercise in division may be written in the form of a fraction. For example, $3\overline{)24}$ may be written as $\frac{24}{3}$. Hence, changing $3\overline{)24}$ to $30\overline{)240}$ is the same as changing $\frac{24}{3}$ to $\frac{240}{30}$ by multiplying both numerator and denominator by 10. In similar manner you can explain why it is possible to change $3\overline{)24}$ to $300\overline{)2400}$. The principle stated in ex. 1 on page 220 is applied in ex. 2, which should be studied carefully. In this work, the children should notice that the original example is $.45\overline{)12.15}$ and that it is changed to $45\overline{)1215}$ by multiplying both .45 and 12.15 by 100. The new example, $45\overline{)1215}$, is then worked to get an answer of 27. Thus, the answer to $.45\overline{)12.15}$ is 27.

Key: 3. 12 yd.; 25 yd.

Pages 221–222

Aim: To continue practice in division by decimal fractions

Suggestions: Although the illustrative examples on both pages 221 and 222 continue to require the pupil to rewrite the examples by making the divisors whole numbers, some pupils will quickly realize that this rewriting procedure is the long way to do the work. Many short cuts have been devised, and the modern teacher will urge her class to invent a method or methods of their own. Some pupils will, in copying the example from the textbook, immediately write the new version of the example. Others will use the directional arrow:

$$\begin{array}{r} \bullet\; \\ .04_{\curvearrowright}\overline{)7.0\,0_{\curvearrowright}} \end{array}$$

Still others will use the "caret" device illustrated below:

$$\begin{array}{r} \bullet\; \\ .04_{\wedge}\overline{)7.0\,0_{\wedge}} \end{array}$$

Although the teacher *should not impose* any of the short cuts on the class, the brighter pupil should acquire one of them in short order since:

1. It will save time.
2. It will show exactly what happens to the decimal point in the divisor, the dividend, and the quotient.
3. It will not destroy the original example and will thus facilitate checking.

Pupils who wish to continue rewriting the entire example should be allowed to do so. However, continued emphasis must be placed on the mathematical principle which allows the change in divisor and dividend to take place.

Workbook Reference: Arithmetic Workshop, Book 6, pages 93 to 95

Key: Page 221 **1.** 14 rods. **2.** 13 wk.; 26 wk. **4.** 35; 9; 69; 63. **5.** 27; 36; 93; 87. **6.** 62; 8; 76; 48. **7.** 28; 23; 93; 96. **8.** 83; 7; 67; 89.

Page 222 **2.** 48.6 mi. **3.** 3.5 mi. **4.** 5.5 mi.; 330 mi. **5.** 357 mi. **6.** 5.3; 5.7; 7; .715; 1.6; 25.1. **7.** 2.8; 16; .4; .3; 1.8; 21.8. **8.** 8.4; 9.5; .9; 86.8; 1687.5; 42. **9.** 1.5; 1.2; 3.75; 4.2; 1510; 858.

Page 223

Aim: To present a set of improvement tests in subtraction

Suggestion: This set of improvement tests in subtraction should be administered in the same way as preceding sets. See page 328 of the text.

Key: **1.** $392.81; $120.75; $248.56; $487.78. **2.** $352.64; $89.63; $134.38; $156.28. **3.** $469.95; $37.43; $458.66; $97.57. **4.** $196.14; $72.67; $782.99; $422.59. **5.** $123.08; $341.87; $91.99; $619.98. **6.** $267.36; $64.81; $241.08; $4.83. **7.** $52.27; $65.70; $173.85; $431.87. **8.** $69.49; $274.53; $89.66; $233.08. **9.** $95.79; $81.56; $595.24; $489.77.

Page 224

Aim: To provide mixed practice in whole numbers, common fractions, and decimal fractions

Key: **1.** $13.75. **2.** 15,218 mi. **3.** $102.70. **4.** 539.78 sq. ft. **5.** 1497; 1.875; 15.89; 4697.4; $5791.77. **6.** 3938; 1.625; 23.06; 1529.0; $419.83. **7.** 2836; 4.625; 38.08; 7852.6; $864.60. **8.** 946.528; 19.25; 11.25; .618; .048; 174.432. **9.** 3,352,320; 24.00; 8.75; 1.476; .048; 35.478. **10.** 879,428; 3.768; 15.012; .473; .696; 150.088.

Pages 225–226

Aim: To present certain zero difficulties in the division of decimals

Suggestion: The model examples and explanations given in ex. 1 and 2 on page 225 require careful study, as do the model examples in ex. 1 on page 226.

Key: Page 225 **3.** .06; .085; .027; 5800; 340; 360. **4.** .09; .065; .039; 6400; 270; 620. **5.** .08; .095; .019; 2200; 810; 180. **6.** .07; .075; .009; 590; 730; 210. **7.** .08; .045; .005; 260; 900; 360. **8.** .06; .095; .008; 620; 600; 420. **9.** .09; .08; .009; 7700; 890; 760.

Page 226 **2.** .04; .09; .04; 3100; .06; 190. **3.** .03; .08; .02; 7300; .04; 1200. **4.** .06; .08; 50; 1800; .06; 430. **5.** .09; .09; 90; 8600; .07; 1700. **6.** .1; .3; .8; 96.7; 1.2; 17.1. **7.** .2; .1; .8; 38.9; .5; .3. **8.** .2; .1; 1.6; 342.9; 12.7; .8. **9.** 3.15; 7.10; 7.38; 1.24; 7.74. **10.** 5.79; .41; .63; .85; 40.11. **11.** 2.83; .85; 2.78; 3.03; 4.45. **12.** 1.79; .77; 6.60; 7.08; 6.22.

Page 227

Aim: To present word problems involving division of decimals

Key: **1.** $.18. **2.** $.04½; $.36. **3.** $.67. **4.** About 112 ft. **5.** $.09. **6.** $.05. **7.** 3.7; 164.4; 2.7; 147. **8.** 20.8; 1290; 37; 8.3.

Pages 228–229

Aim: To develop an ability to estimate correct answers in solving problems involving decimal fractions

Suggestions: Many pupils overlook the fact that mixed decimals such as $6.07, $7.95, and $4.99 are in reality very close in value to the whole numbers $6, $8, and $5 respectively. The skill of estimating answers involving mixed decimals is to round off the decimal number to the nearest whole number. When the number is rounded off, the example then becomes a matter of estimating in whole numbers; and the misplacement of the decimal point is avoided.

The work on page 229 continues this skill, but deals in abstract numbers only. All the work on this page may be completed orally and provides an excellent opportunity for the teacher to evaluate the extent to which the class has mastered this skill. In ex. 1, the estimating thought is 25 ÷ 8 is 3; so the answer must be about 3. In ex. 2, 1 ÷ 2 is ½. In ex. 3, 81 ÷ 37 is a little more than 2, and so on. Beginning with ex. 9, the mental estimation begins with mentally multiplying the divisor by 10, 100, or 1000 and seeing in the "mind's eye" the decimal point as it moves in the dividend:

$$\begin{array}{r} 39 \\ .7\overline{)273} \end{array} \text{ becomes } \begin{array}{r} 390 \\ 7\overline{)2730} \end{array}$$

Key: Page 228 **1.** $7; $7.02. **2.** $6.00; $5.99. **3.** $1.00; $1.10. **4.** 50¢; 47¢ for two girls and 48¢ for two girls. **5.** $150.00; $151.50. **6.** 20 mi.; 20.2 mi. **7.** 100 papers; 97 papers. **8.** $8.00; $8.05. **9.** $4.50; $4.44. **10.** $2.00; $1.97.

Page 229 **1.** 3.2. **2.** .54. **3.** 2.2. **4.** 58. **5.** 6.1. **6.** 890. **7.** .93. **8.** 7.8. **9.** 390.; .036; 6800.; 22.9. **10.** .083; 7.6; 270.; 4030. **11.** 5.7; .084; .041; .063. **12.** 46.; 9.6; 10,400.; 780. **13.** 980.; 940.; .9; 315. **14.** .047; 1.13; 780.; .096. **15.** 69.; 203.; 9240.; 52,100.

Page 230

Aim: To review the major aims of Chapter 6

Suggestion: The test on this page reviews 7 of the 10 major aims as listed in this Guide at the beginning of Chapter 6. These are:

Chapter Review	*Aim Number*
Ex. 1 and 2	2
Ex. 3	8
Ex. 4 and 5	4
Ex. 6 and 7	5
Ex. 8–11	3, 7, 9

Key: **1.** $.11. **2.** $.075. **3.** 2.2 × $1.39 = $3.058, or $3.06. **4.** 6.4; 9.3; 5.8; 7.9; 4.1; 7.0; 14.0; 17.8; .1. **5.** 2.73; 8.31; 5.38; 4.89; 3.10; .18; 9.23. **6.** .25; .8; .5; .375; .75; .875; .45; .7; .05; .24; .65. **7.** .67; .89; .71; .17; .33; .83; .42; .27; .27; .14; .47. **8.** .073; 2.635; .008; 230; .013; 2.15. **9.** 7.3; 3.26; 156.5; .7; 2450; 7.75. **10.** .9; 5.7; 3.0; .2; .1; .9. **11.** .46; 2.83; .84; .59; 5.24; 1.41.

Page 231

Aim: To present Problem Test 6

Key: **1.** $\frac{360}{648} = \frac{5}{9}$. **2.** 144 ÷ 36 = 4; 4 × 10¢ = 40¢. **3.** 29,008 mi. − 20,276 mi. = 8732 mi. **4.** $1\frac{3}{4} \times \$.45 = \$.78\frac{3}{4}$, or $.79. **5.** 32 × $1.75 = $56.00; 85 bu. − 32 bu. = 53 bu., 53 × $2.25 = $119.25; $56.00 + $119.25 = $175.25. **6.** (1) 20.5 mi. ÷ 25 = .82 mi.; (2) 60 × .82 mi. = 49.20 mi. **7.** 73 lb. + $75\frac{1}{2}$ lb. + $77\frac{1}{4}$ lb. = $225\frac{3}{4}$ lb.; $225\frac{3}{4}$ lb. ÷ 3 = $75\frac{1}{4}$ lb. **8.** $33.07 ÷ 68 = $.486, or $.49. **9.** 104 in. ÷ 6 = 17.33 in., or 17.3 in. **10.** 225 mi. − 56 mi. = 169 mi.; 3 × 169 mi. = 507 mi.

Page 232

Aim: To give a diagnostic test with page references for remedial work

Key: **1.** .5; .375; .8; .35; .12. **2.** .88; .83; .44; .67; .82. **3.** 29,000; 6300; 84; 2710. **4.** 8.72; .267; .23; 39.17. **5.** .16; .9; 4.2; .103. **6.** .615; 7.25; 35.4; 9.375. **7.** 9; 7; 28; 1.7. **8.** .008; .06; 1160; 1700. **9.** 3.1; 5.2; 3.8; 1.5. **10.** 228.3; 5.3; 3.4; 226.4. **11.** 246.7; 5.8; 385.7; 253.3.

Chapter 7

Aims of Chapter 7. The major aims of Chapter 7 are to:

1. Review the understandings and skills taught in previous chapters.
2. Extend the reading and making of scale drawings.
3. Teach the business forms *bills* and *receipts.*
4. Reteach the method of finding the area of a rectangle.
5. Help pupils understand the meaning of *volume* and *cubic measure.*
6. Teach the method of finding volume.
7. Relate volume to liquid measure, with emphasis on the cubic content of water.
8. Round off decimal fractions relating to speed.
9. Understand what compound numbers are and show how to add and subtract them.
10. Extend scale drawings to dictionary pictures of animals and birds.
11. Learn how to read and construct picture graphs.

Pages 233–235

Aim: To present problems dealing with the geography, population, and products of Alaska

Suggestions: Before beginning the problems on these pages, it would be desirable to discuss the geography and historical development of Alaska, so that the pupils might become better acquainted with this state. The work in social studies can be correlated with these problems. On page 233 problem 1 should motivate a discussion of what glaciers are. On pages 234 and 235 many large numbers are used in the discussion of land areas, mountain heights, river lengths, and other data. *An understanding of the problem situation* should precede the mechanical solving of the problem if a meaningful approach to estimation of the answer is expected.

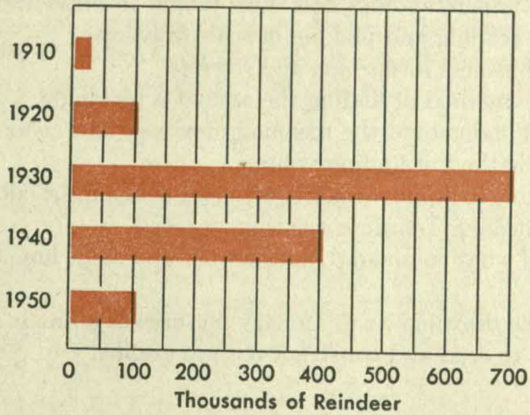
Workbook Reference: Arithmetic Workshop, Book 6, page 67

Key: Page 233 **1.** 1500 sq. mi. − 1214 sq. mi. = 286 sq. mi. **2.** 750 ft. ÷ $12\frac{1}{2}$ ft. = 60 (stories). **3.** .03 × 586,400 sq. mi. = 17,592 sq. mi.

Pages 234–235 **1.** (1) 586,400 × \$12.30 = \$7,212,720.00, yes; (2) \$12.30 ÷ 640 = \$.019, or \$.02. **2.** $\frac{1}{4}$ × 3,615,212 sq. mi. = 903,803 sq. mi., $\frac{1}{5}$ × 3,615,212 sq. mi. = 723,042 sq. mi., $\frac{1}{6}$ × 3,615,212 sq. mi. = 602,535 sq. mi. 586,400 sq. mi. is closest to 602,535 sq. mi., so Alaska is about $\frac{1}{6}$ the total of the United States. **3.** 586,400 ÷ 267,340 = $2\frac{2686}{13367}$, so Alaska is about 2 times the size of Texas. **4.** (1) 385,000 + 65,000 + 35,000 = 485,000 (sq. mi.); (2) $\frac{3}{4}$ × 586,400 sq. mi. = 439,800 sq. mi., $\frac{5}{6}$ × 586,400 sq. mi. = $488{,}666\frac{2}{3}$ sq. mi., so the productive area of Alaska is about $\frac{5}{6}$ of the total area. **5.** (1) 4 × 5280 ft. = 21,120 ft., yes; (2) 21,120 ft. − 20,300 ft. = 820 ft. **6.** (1) 20,300 ft. − 14,495 ft. = 5805 ft.; (2) 1 mi. = 5280 ft., so Mt. McKinley is more than 1 mi. higher; (3) Mt. Rainier. **7.** (1) 2470 mi. − 2300 mi. = 170 mi.; (2) 2432 mi. − 2300 mi. = 132 mi.

8. (1) 128,811 + 97,356 = 226,167; (2) .57 × 226,167 = 128,915, yes; (3) 97,356 ÷ 226,167 = .43. **9.** 1523 ÷ 30 = $50\frac{23}{30}$, or 51 (hr.). **10.** 241,000 × \$35 = \$8,435,000. **11.** Let 22,000 equal 25,000, and 93,000 equal 100,000.

Reindeer in Alaska



Page 236

Aim: To teach scale drawing slightly more difficult than the scale drawing taught in Grade 5

Suggestions: Scale drawing of an easier type was first presented in Grade 5 of this series. It is a somewhat difficult topic for many pupils of the sixth grade because, in general, they have had little or no experience with drawings of this kind. At the beginning, make clear that success in scale drawing depends upon making actual scale drawings, using a ruler on which the inch is divided into eighths. Another element necessary for success in scale drawing is to have ample time for this topic, going slowly step by step to be sure the work is understood.

In first presenting scale drawing, the meaning of a scale, such as 1 in. = 1 ft., must be made clear. If the pupil understands what it means to have 1 inch on paper represent 1 foot on the top of a table (see ex. 1 on page 236), it will be easy to make a scale drawing showing a table top 2 ft. wide and 6 ft. long. If the scale is changed to $\frac{1}{2}$ in. = 1 ft., a smaller drawing is obtained. If the scale is changed to $\frac{1}{4}$ in. = 1 ft., a still smaller drawing is obtained. Unless you start the work in some such simple way as this, the pupils may encounter difficulty.

Ex. 2 on page 236 uses a scale of $\frac{1}{8}$ in. = 1 ft. In a case like this, the teacher should begin with oral exercises such as the following: If $\frac{1}{8}$ in. stands for 1 ft., how many inches stand for 2 ft.? for 3 ft.? for 4 ft.? In ex. 2 the pupils are asked to measure the scale drawing in the book to see whether it has been correctly drawn. You will have to show the pupils how this is done. The room is supposed to be 16 ft. long. If $\frac{1}{8}$ in. equals 1 ft., show the pupils that the line must be $16 \times \frac{1}{8}$ in., or 2 in., to represent 16 ft. Then see whether the drawing in the book is 2 in. long. Check the width of the drawing in the same way. Careful work will show that Bob did draw the rug correctly.

In ex. 4 the scale is 1 in. = 25 ft. To represent 75 ft., the pupils will have to find how many 25's there are in 75, which is 3. So a line 3 in. long represents 75 ft. Likewise, by finding how many 25's there are in 125, the pupils will find that a line 5 in. long represents 125 ft.

Workbook Reference: Arithmetic Workshop, Book 6, pages 106 and 107

Key: **1.** $\frac{1}{2}$ in.; $1\frac{1}{2}$ in.; yes. **2.** $1\frac{1}{2}$ in.; 2 in.; yes. **3.** $\frac{3}{8}$ in.; $\frac{1}{4}$ in. **5.** $2\frac{1}{2}$ in.; 4 in.; $7\frac{1}{4}$ in.; 8 in. **6.** Room, 10 in. × 7 in.; rug, $4\frac{1}{2}$ in. × $7\frac{1}{2}$ in. **7.** 2 in.; 6 in.

Page 237

Aims: To present a new set of improvement tests in multiplication and to review basic skills in whole numbers and fractions

Suggestion: See page 328 of the textbook for instructions on giving these tests.

Key: **1.** 261,555; 83,068; 200,392; 144,951; 92,664; 151,214. **2.** 292,422; 315,078; 344,960; 825,608; 72,105; 266,976. **3.** 62,785; 345,762; 65,603; 474,370; 362,793; 839,796. **4.** 417,772; 41,044; $4\frac{1}{10}$; 24. **5.** 53; 1614 R12; 2; $6\frac{5}{8}$. **6.** 756; $5.84; $6\frac{1}{4}$; $17\frac{1}{2}$. **7.** 392,850; 886; $5\frac{5}{6}$; $\frac{9}{16}$. **8.** $25\frac{1}{4}$; 10,000; 10; $\frac{2}{3}$. **9.** 17.628; 59; 45; $1\frac{3}{4}$. **10.** 43; $5.57; $\frac{5}{16}$; $\frac{9}{16}$. **11.** 321,200; 11.66; $10\frac{1}{2}$; $\frac{3}{5}$. **12.** $7\frac{3}{5}$; 46; $3\frac{11}{12}$; $11\frac{1}{4}$. **13.** .896; .2464; $1\frac{1}{4}$; $\frac{11}{16}$. **14.** $19\frac{7}{12}$; $10.30; $9\frac{1}{8}$; $6\frac{2}{3}$.

Page 238

Aim: To extend the application of scale drawings to include maps

Suggestions: The reading of maps is an important part of a pupil's learning. Ex. 1, 4, and 5 provide opportunities for pupils to use scale drawings in figuring distances on maps. Work in social studies can be correlated with these problems.

Key: **1.** $1\frac{1}{4}$ × 80 mi. = 100 mi. **2.** $2\frac{1}{2}$ in.; 5 in. **3.** 5 in. **4.** 600 mi.; 210 mi.; 105 mi.; 435 mi. **6.** 6 in. × 6 in. **7.** $4\frac{1}{2}$ in. × $4\frac{1}{2}$ in. **8.** 2 in. × 3 in.; $3\frac{3}{4}$ in. × $4\frac{1}{2}$ in.; 4 in. × 5 in. **9.** $1\frac{1}{2}$ in. × $2\frac{1}{2}$ in.; 6 in. × 6 in.; $3\frac{1}{2}$ in. × $4\frac{1}{2}$ in. **10.** 1 in. × $4\frac{1}{3}$ in.; 5 in. × $6\frac{1}{4}$ in.; 3 in. × 6 in. **11.** $1\frac{3}{4}$ in. × $4\frac{3}{4}$ in.; $4\frac{1}{2}$ in. × $7\frac{1}{2}$ in.; $4\frac{1}{4}$ in. × $5\frac{1}{2}$ in.

Page 239

Aim: To present problems on the geography, population, and products of Hawaii

Suggestions: Some discussion of the geography and historical development of Hawaii would be desirable before the problems on this page are solved.

Key: **1.** $\frac{1}{90}$. **2.** 632,772. **3.** 34,139,000 cases; 819,336,000 cans. **4.** 20,268. **5.** 4.5 hr.

Page 240

Aim: To give more practice in the use of scale drawings

Key: **1.** 3 ft.; 5 ft.; 7 ft.; 8 ft.; 9 ft. **2.** Yes; 19 ft.; 14 ft. **3.** 19 ft.; yes. **4.** Kitchen, 14 ft. × 7 ft.; bedroom, 18 ft. × 9 ft.; bathroom, 9 ft. × 6 ft. **5.** 5 ft.; 3 ft.; 2 ft.

Page 241

Aims: To show how receipts are written and to give practice in writing them

Suggestions: The pupils should be given practice in writing receipts, as suggested in ex. 3–6. Additional practice in such work can easily be assigned.

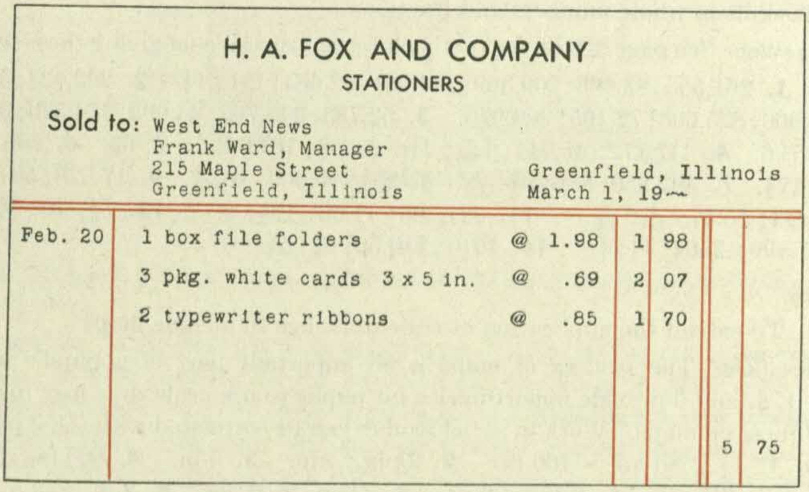
Pages 242–243

Aim: To give practice in making out bills

Suggestion: The bill which is shown in ex. 1 on page 242 should be studied carefully so that the pupils will become acquainted with the usual form of making out such bills.

Key: Page 242 **2.** Yes.

6.



H. A. FOX AND COMPANY
STATIONERS

Sold to: West End News
Frank Ward, Manager
215 Maple Street
Greenfield, Illinois

Greenfield, Illinois
March 1, 19—

Feb. 20	1 box file folders	@ 1.98	1	98		
	3 pkg. white cards 3 x 5 in.	@ .69	2	07		
	2 typewriter ribbons	@ .85	1	70		
					5	75

Page 243 **2.** 4 × $1.28 = $5.12; 2 × $.29 = $.58; ½ × $1.40 = $.70; $5.12 + $.58 + $.50 + $.70 = $6.90. **4.** 12 × $.28 = $3.36; 6 × $.45 = $2.70; 2 × $.89 = $1.78; $3.36 + $2.70 + $1.25 + $1.78 = $9.09. **6.** 3½ × $.47 = $1.64½, or $1.65; ½ × $.69 = $.34½, or $.35; 2 × $.56 = $1.12, 3 × $.19 = $.57; $1.65 + $.35 + $1.12 + $.57 = $3.69. **7.** 4 × $1.49 = $5.96; 2 × $1.79 = $3.58; 2 × $4.67 = $9.34; $5.96 + $3.58 + $9.34 + $7.95 = $26.83. **8.** 4 × $3.98 = $15.92; 3 × $1.83 = $5.49; 2 × $.94 = $1.88; 2 × $1.85 = $3.70; $15.92 + $5.49 + $1.88 + $3.70 = $26.99.

Page 244

Aim: To use scale drawings to assist in the discovery of the method of determining the area of a rectangle

Suggestions: Problem 1 illustrates how a scale drawing can help to prove the area of the rectangle is 24 sq. ft. It would be difficult to draw a rectangle 6 ft. by 4 ft. on the blackboard and make the squares to represent 24 square feet. However, with the help of the work on pages 238–240, a scale drawing can easily be made. Problem 3 extends area scale drawings to include square miles, with 1″ = 10 mi. Ex. 5–7 introduce tenths of a mile.

Key: **1.** 24 sq. ft.; 1 sq. ft. **2.** The scale drawing should be 10 in. × 6 in.; the area is 240 sq. ft. **3.** The scale drawing should be 6 in. × 5 in.; the area should be 3000 sq. mi. **4.** 28 sq. ft. **5.** 80 sq. in.; $7\frac{1}{2}$ ft. × 10 ft. = 75 sq. ft.; 81.2 sq. mi. **6.** 273 sq. ft.; $6\frac{1}{4}$ ft. × 20 ft. = 125 sq. ft.; 4.32 sq. in. **7.** 126 sq. yd.; $2\frac{1}{3}$ yd. × 11 yd. = $25\frac{2}{3}$ sq. yd.; 15.54 sq. mi.

Page 245

Aim: To give problems in determining the area of rectangles

Suggestion: The rule for finding the area of a rectangle was stated on page 244. Pupils should now feel free to use it.

Key: **1.** 45 ft. × 60 ft. = 2700 sq. ft.; 2700 ÷ 200 = $13\frac{1}{2}$ (lb.). **2.** $\frac{1}{2}$ × 43,560 sq. ft. = 21,780 sq. ft.; 21,780 ÷ 1000 = 21.78 (thousands); 21.78 × 100 lb. = 2178 lb. **3.** (1) 2178 ÷ 100 = 21.78 (bags), or 22 bags; (2) 22 × \$.85 = \$18.70. **4.** 65 ft. × 75 ft. = 4875 sq. ft.; 4875 ÷ 100 = 48.75 (hundreds); 48.75 × 8 lb. = 390 lb. **5.** (1) 390 ÷ 80 = $4\frac{7}{8}$ (bags), or 5 bags; (2) 5 × 80 lb. = 400 lb., 400 lb. − 390 lb. = 10 lb.; (3) 5 × \$3.25 = \$16.25. **6.** $\frac{1}{4}$ × 43,560 sq. ft. = 10,890 sq. ft.; 10,890 ÷ 50 = $217\frac{4}{5}$, or 218 gardens.

Pages 246–249

Aims: To teach the pupils how to find the volumes of rectangular solids and to develop the table of cubic measure

Suggestions: The concept of volume is a difficult one for pupils; hence, you should try to make this work as real as possible. In developing the volume of a rectangular solid, as is done on page 246, it will be helpful to use an actual box, such as a shoe box or a chalk box, using inch cubes to fill the box if such cubes are available. Possibly such cubes can be borrowed from one of the teachers of the primary grades. In all this work encourage the pupils to measure the dimensions of boxes of various sizes and to compute their volumes. The more real and practical this topic can be made, the better it will be understood by the pupils.

On page 246 the cubic inch has been used as the unit of measure, whereas on page 247 the cubic foot and the cubic yard are also introduced as units of measure. If the pupils are finding the volume of a large wooden box whose dimensions are measured in feet, they should, of course, find the volume in cubic feet. Emphasize the fact that in finding the volume of a rectangular solid, each of the three dimensions must be expressed in the *same unit of measure;* that is, each dimension must be in inches, or in feet, or in yards. On page 248, ex. 1 and 2 lead to the development of the table of cubic measure, which is given in ex. 3.

The work on page 249 is devoted to the measurement of liquids. When we wish to find the number of gallons of water that a small rectangular solid, such as an aquarium or a tin can, will hold, we may use the fact that 1 gal. fills a space of 231 cu. in. This equivalent is used in ex. 1, 2, 3, 4, and 7 on page 249. When the rectangular solid is larger, such as a tank or a swimming pool, we usually use the fact that 1 cu. ft. = $7\frac{1}{2}$ gal. This amount is an approximate equivalent which is sufficiently accurate for most practical purposes; it is used in ex. 5 and 6 on page 249. It is an easy matter to show the pupils that 1 cu. ft. = about $7\frac{1}{2}$ gal. There are 1728 cu. in. in 1 cu. ft. If you divide 1728 by 231, you get $7\frac{111}{231}$, which is *about* $7\frac{1}{2}$. Hence, there are *about* $7\frac{1}{2}$ gal. in 1 cu. ft.

Workbook Reference: Arithmetic Workshop, Book 6, pages 101 and 102

Key: Page 246 **4.** Yes. **5.** 42 cu. in.; 3080 cu. in. **6.** 135 cu. in.; 2160 cu. in. **7.** 8 cu. in.; 300 cu. in.

Page 247 **2.** 24 cu. ft. **3.** 1 ft. × 2 ft. × 3 ft. = 6 cu. ft., 2 ft. × 2 ft. × 2 ft. = 8 cu. ft.; so the box 2 ft. × 2 ft. × 2 ft. will hold more. **5.** 4 ft. × $1\frac{1}{2}$ ft. × 1 ft. = 6 cu. ft. **6.** (1) 120 cu. ft.; (2) 3 ft. × 6 ft. × $\frac{1}{2}$ ft. = 9 cu. ft.; (3) $\frac{2}{3}$ ft. × 3 ft. × $\frac{1}{2}$ ft. = 1 cu. ft. **7.** (1) 216 cu. in.; (2) 4 ft. × 5 ft. × $\frac{3}{4}$ ft. = 15 cu. ft.; (3) $\frac{1}{2}$ ft. × 4 ft. × $\frac{1}{4}$ ft. = $\frac{1}{2}$ cu. ft. **8.** (1) 48 cu. in.; (2) 2 ft. × $\frac{2}{3}$ ft. × $1\frac{1}{2}$ ft. = 2 cu. ft.; (3) $1\frac{1}{2}$ ft. × 8 ft. × 1 ft. = 12 cu. ft.

Page 248 **4.** 5184 cu. in.; 4320 cu. in. **5.** 135 cu. ft.; $94\frac{1}{2}$ cu. ft. **6.** 2 cu. yd.; 3 cu. yd.; 6 cu. yd.; $\frac{2}{3}$ cu. yd. **7.** 3 × 1728 cu. in. = 5184 cu. in.; so 5000 cu. in. is less than 3 cu. ft. **8.** 24 in. = 2 ft., 9 in. = $\frac{3}{4}$ ft., 7 in. = $\frac{7}{12}$ ft.; 2 ft. × $\frac{3}{4}$ ft. × $\frac{7}{12}$ ft. = $\frac{7}{8}$ cu. ft.; so Bob needs less than 1 cu. ft. of soil. **9.** 33 ft. = 11 yd., 18 ft. = 6 yd., 8 ft. = $2\frac{2}{3}$ yd.; 11 × 6 × $2\frac{2}{3}$ = 176 (cu. yd.). **10.** (1) 30 × 25 × 12 = 9000 (cu. ft.); (2) 26 × 200 cu. ft. = 5200 cu. ft., so there is more than enough air space for 26 pupils.

Page 249 **1.** 11 × 21 × 12 = 2772 (cu. in.); 2772 ÷ 231 = 12 (gal.). **2.** 6 × 11 × 7 = 462 (cu. in.); 462 ÷ 231 = 2 (gal.). **3.** $3\frac{1}{2}$ × 6 = 21; 231 ÷ 21 = 11 (in.). **4.** $5\frac{1}{2}$ × 7 × $12\frac{1}{8}$ = $466\frac{13}{16}$ (cu. in.), which is close to 2 gal. **5.** 6 × 3 × 4 = 72 (cu. ft.); $7\frac{1}{2}$ × 72 = 540 (gal.). **6.** $2\frac{1}{2}$ × 90 × $\frac{2}{3}$ = 150 (cu. ft.); $7\frac{1}{2}$ × 150 = 1125 (gal.). **7.** (1) 231 cu. in. ÷ 4 = $57\frac{3}{4}$ cu. in., or 58 cu. in.; (2) 231 cu. in. ÷ 8 = $28\frac{7}{8}$ cu. in., or 29 cu. in. **8.** (1) $58\frac{1}{2}$ cu. in., or about 1 qt.; (2) $30\frac{5}{8}$ cu. in., or about 1 pt.; (3) $30\frac{15}{16}$ cu. in., or about 1 pt. **9.** (1) 59 cu. in., or about 1 qt.; (2) $30\frac{15}{32}$ cu. in., or about 1 pt.; (3) $60\frac{1}{2}$ cu. in., or about 1 qt.

Page 250

Aim: To calculate the costs of a swimming pool

Suggestion: One of the immediate applications of volume as it relates to liquid measure is found in studying the water costs of filling and maintaining a swimming pool.

Workbook Reference: Arithmetic Workshop, Book 6, page 104

Key: **1.** (1) 60 × 35 × 6 = 12,600 (cu. ft.); (2) $7\frac{1}{2}$ × 12,600 = 94,500 (gal.). **2.** 12,600 ÷ 100 = 126 (hundreds); 126 × 18¢ = 2268¢, or \$22.68. **3.** (1) 90 × 40 × 6 = 21,600 (cu. ft.), 21,600 ÷ 100 = 216 (hundreds), 216 × 24¢ = 5184¢, or \$51.84; (2) 216 × 16.5¢ = 3564¢, or \$35.64. **4.** 90 × 40 × $5\frac{2}{3}$ = 20,400 (cu. ft.); 21,600 − 20,400 = 1200 (cu. ft.); $7\frac{1}{2}$ × 1200 = 9000 (gal.).

Page 251

Aims: To provide another set of improvement tests in division and to review basic vocabulary

Key: **1.** $450\frac{2}{3}$; 962; 835. **2.** $827\frac{1}{4}$; $713\frac{17}{58}$; 609. **3.** 569; 308; $295\frac{3}{8}$. **4.** $847\frac{11}{19}$; $786\frac{1}{5}$; 490. **5.** 604; $517\frac{3}{4}$; $921\frac{1}{2}$. **6.** 762; $830\frac{10}{43}$; 349. **7.** Average. **8.** Hundredths. **9.** Common denominator. **10.** Round off. **11.** Perimeter. **12.** Invert. **13.** Area. **14.** Divisible; divisible. **15.** Estimate.

Page 252

Aim: To review decimal fractions and 3-figure divisors in long division

Suggestions: Problems 3–6 involve finding averages which are to be calculated to tenths or hundredths. Such calculations make sense when applied to mileage, dollar costs, and speed. In dealing with data which can be expressed fractionally, then the answer can become a fraction. However, when applied to persons, such an answer becomes ridiculous. There is no such thing as 32.07 children! This is the time to explain to your class that the *content of the problem* determines the form of the answer. In dealing with data that cannot be expressed fractionally, such as children, baseballs, touchdowns, and so on, the answer is expressed to the nearest whole number.

Key: **1.** \$115.94 ÷ 31 = \$3.74. **2.** 14,716 mi. ÷ 52 = 283 mi. **3.** 2264 mi. ÷ 48 = 47.16 mi., or 47.2 mi. **4.** \$925 ÷ 217 = \$4.262, or \$4.26. **5.** 12,414 ÷ 387 = 32.0, or about 32 pupils. **6.** 2900 mi. ÷ 7 = 414.285 mi., or 414.29 mi. **7.** 72; 290 R21; 57; 334. **8.** 65; 390 R14; 29; 258. **9.** 38 R12; 467 R8; 68 R19; 764. **10.** 27 R5; 305 R25; 38 R132; 525 R240. **11.** 37; 324; 83 R24; 501. **12.** 42 R17; 803 R22; 37 R20; 375 R230. **13.** 25 R19; 4008; 28; 719 R201. **14.** 49 R37; 2465 R8; 86 R29; 460.

Page 253

Aim: To provide a comprehensive review of decimal fractions and mixed decimals

Key: **1.** 1.11; 16.1; 1.13; 14.99; 4232.2; 2919.8. **2.** 1.36; 7.3; 1.23; 21.02; 14,995.8; 10,529.5. **3.** .39, 1.3, .47, 7.49, 460.8, 972.2; .44, 0.9, 0.45, 11.68, 1016.8, 638.5. **4.** .25; .375; .75; .5; .7; .03; .041; .009. **5.** .3; .6; .8; .2; .7; .4; .7; .2. **6.** .8; .625; .6; .8. **7.** $\frac{7}{20}$; $\frac{3}{4}$; $\frac{5}{8}$; $\frac{3}{5}$; $\frac{21}{25}$; $\frac{7}{8}$. **8.** .27; $\frac{1}{3}$; $\frac{3}{8}$; .669. **9.** $\frac{3}{4}$; .65; .355; $\frac{7}{8}$. **10.** 1.3; 4.4; 58; 17. **11.** 65; 38.4; 650; .032. **12.** 1060; 4.4; .65; .85. **13.** 5.52; .595; 18.125; .072; 66.375; 168.500.

Pages 254–256

Aim: To continue practice in rounding off decimal fractions

Suggestions: Speeds are usually quoted in terms of decimal fractions or mixed decimals. Pupils who are interested in automobile, airplane, or train speeds will discuss comparisons of speeds in terms of decimal fractions usually stated in tenths of a mile. Problem 1 on page 254 explains how to determine speed to the nearest mile, whereas problem 2 extends this computation to the nearest tenth of a mile. In each case decimal fractions are rounded off. Problem 4 on page 255 introduces the concept of .1 of an hour, which can easily be associated with the modern time clock used in industry. Some of these clocks are divided into tenths of an hour, but most of them are divided into hundredths of an hour. Problems 5–7 on page 255 provide further practice in the skill of changing minutes to tenths or hundredths of an hour.

Problem 1 on page 256 discusses one of the most famous flights of all time. Notice that 33½ hours is changed to 33.5 hours before computation is started. All common fractions found in these problems are to be changed to decimal fractions. Making such equivalents *should become routine* from this point on, since in adult life all such computation is completed by means of the decimal rather than the common fraction.

Workbook Reference: Arithmetic Workshop, Book 6, pages 96 and 97

Key: Pages 254–255 **3.** 91 mi. **4.** 222 mi. **5.** 548 mi. **6.** 584 mi. **7.** 5 hr. 28 min. is about 5.5 hr.; 2454 mi. ÷ 5.5 = about 446 mi.

Page 256 **1.** 109 mi. **2.** (1) 3641 mi. ÷ 16.5 = about 221 mi.; (2) 221 ÷ 109 = about 2 (times). **3.** 209 mi. **4.** 23,452 mi. ÷ 94 = about 249 mi. **5.** 3300 mi. ÷ 10 = about 330 mi. **6.** 4900 ÷ 4.70 = about 1043 mi. **7.** 29 min. 15 sec. is about .5 hr.; 214 mi. ÷ .5 = 428 mi.

Page 257

Aim: To study a large magic square which is made up of 9 smaller magic squares

Suggestions: A study of the large magic square given on this page will bring out many interesting facts. You see that the large square has 9 numbers in each row, 9 numbers in each column, and 9 numbers in each diagonal. The sums of these rows, columns, and diagonals are all alike. There are 20 such sums. This large magic square is made up of 9 smaller squares. Each of these smaller squares is a magic square.

Key: **1.** 20 equal sums; 369.

3.

42	231	96
177	123	69
150	15	204

Pages 258–259

Aim: To give a simple introduction to addition and subtraction of compound numbers

Suggestions: Today most of the work on compound numbers is confined to numbers of two denominations, such as 5 ft. 2 in. and 3 lb. 5 oz. A compound number of three denominations, such as 5 yd. 2 ft. 6 in., is seldom used.

Key: Page 258 **5.** 52; 3, 2. **6.** 91; 2, 11. **7.** 111; 5, 3. **8.** 9; 8, 1. **9.** 247; 1, 35. **11.** 16 ft. 30 in., or 18 ft. 6 in.

Page 259 **1.** 2 lb. 33 oz., or 4 lb. 1 oz. **2.** 7 lb. 21 oz., or 8 lb. 5 oz. **3.** 7 hr. 80 min., or 8 hr. 20 min. **4.** 16 ft. 19 in., or 17 ft. 7 in.; 9 da. 49 hr., or 11 da. 1 hr.; 18 gal. 6 qt., or 19 gal. 2 qt. **6.** 7 ft. 12 in. − 2 ft. 8 in. = 5 ft. 4 in. **7.** 5 lb. 7 oz.; 7 hr. 92 min. − 3 hr. 40 min. = 4 hr. 52 min.; 8 ft. 15 in. − 2 ft. 10 in. = 6 ft. 5 in. **8.** 3 da. 35 hr. − 1 da. 20 hr. = 2 da. 15 hr.; 6 bu. 5 pk. − 2 bu. 3 pk. = 4 bu. 2 pk.; 7 qt. 2 pt. − 2 qt. 1 pt. = 5 qt. 1 pt.

Pages 260–261

Aim: To show a practical application of compound numbers

Suggestions: The reading of charts and graphs is an important part of a pupil's learning. Many social-studies experiences are projected by means of charts and graphs. In reading a table which expresses *standard* or *average* ratings or scores, pupils should realize that there is no such thing as the *average boy or girl*. The *average* is a mathematical concept, and only by accident does a person coincide with the average. As many people will be above the average as below the average. No stigma should be attached to being below average, nor should any thrill of exhilaration be experienced from being above average. Most persons will find themselves above the average in certain things and below the average in other things. Certainly this statement is true in school. Whereas some pupils excel in reading, others excel in arithmetic. Whereas some pupils excel in scholarship in general, others excel in physical or social graces. Few people excel in every activity of life. Pupils will volunteer information on this point by indicating that some of their classmates are fine musicians or artists while others are good athletes. Even from the chart on page 260, the pupils can see that some boys and girls might be above average in the jumps and below average in the dashes.

Key: **2.** Standing broad jump, 4 ft. 4 in.; running broad jump, 7 ft.; 50-yard dash, 9 sec.; ball throw, 32 ft.; better. **3.** 4 ft. 14 in. − 4 ft. 6 in. = 8 in. **4.** (1) 3 ft.; (2) $7\frac{8}{5}$ sec. − $7\frac{4}{5}$ sec. = $\frac{4}{5}$ sec.; (3) 22 ft. **5.** 43 ft. − 32 ft. = 11 ft. **6.** $\frac{4}{5}$ sec. **7.** Age 11. **8.** 6 ft. 14 in. − 6 ft. 6 in. = 8 in. **9.** Age 11: 7 ft. 15 in. − 6 ft. 6 in. = 1 ft. 9 in.; age 12: 2 ft. 3 in.; age 13: 9 ft. 12 in. − 7 ft. 2 in. = 2 ft. 10 in.; age 14: 3 ft. **10.** 45 ft. 12 in. − 41 ft. 9 in. = 4 ft. 3 in. **11.** $7\frac{11}{10}$ sec. − $7\frac{8}{10}$ sec. = $\frac{3}{10}$ sec. **12.** 8 ft. 13 in. − 8 ft. 8 in. = 5 in.; Tom is above standard, but Frank is below standard.

Page 262

Aims: To show another type of scale drawing and to give practice in interpreting it

Suggestion: In connection with this work, have the pupils look in an unabridged dictionary and find pictures of animals and insects. In each case the size of the animal or the insect is indicated by a scale similar to those described on page 262.

Key: **1.** 220 × 2 in. = 440 in.; 440 in. = 36 ft. 8 in. **2.** (1) 50 times; (2) 2 × 50 in. = 100 in., or 8 ft. 4 in. **4.** 3 in. **5.** 4 in.

Page 263

Aims: To give another set of improvement tests in addition and to review basic skills in common fractions

Suggestions: Instructions for giving these improvement tests are now well known to both pupil and teacher. Reference pages are pages 54–58 and 328 in the textbook.

Key: **1.** 2080; 2694; 3321; 3873; 4068; 3354. **2.** 4132; 4018; 4000; 3583; 3451; 4210. **3.** 2943; 4096; 3787; 4156; 3008; 3220. **4.** $1\frac{1}{8}$; $3\frac{3}{4}$; $\frac{2}{5}$; $2\frac{5}{8}$; 10. **5.** $\frac{1}{3}$; $1\frac{1}{10}$; $1\frac{1}{4}$; $5\frac{11}{12}$; $11\frac{1}{4}$. **6.** $1\frac{1}{4}$; $\frac{1}{2}$; $4\frac{1}{2}$; $2\frac{1}{4}$; $\frac{3}{8}$.

Pages 264–265

Aim: To teach the reading and making of picture graphs

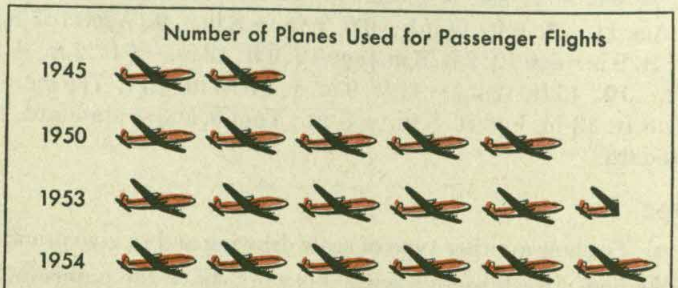
Suggestions: Bar graphs were introduced on page 28, and line graphs were introduced on page 58. Since picture graphs are becoming a popular way to present statistics to readers, social-studies books use them frequently. Although they are very easy to read, their construction is more difficult than that of either the bar or the line graph. Page 264 presents exercises in the reading of picture graphs. Ex. 4 suggests that pupils find such graphs in newspapers and magazines. *Business Week*, *Newsweek*, and *Time* have many picture graphs.

Page 265 provides an opportunity for making simple picture graphs, and problem 1 explains the way a picture graph can be constructed. Notice that in problems 4 and 5 the pupils must read tables in order to build the graphs. At this point you may indicate the three ways of presenting data:

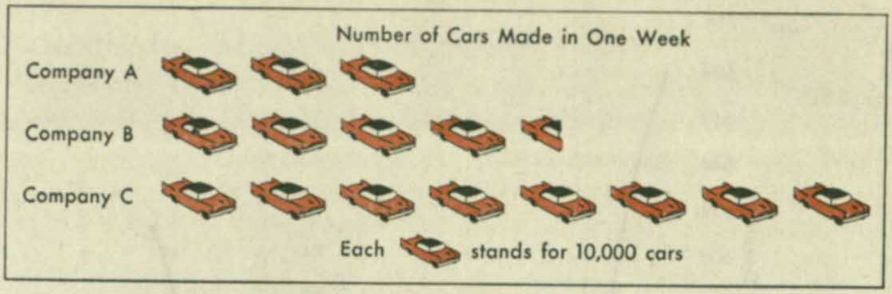
1. By writing it out in paragraph form (See problem 2.)
2. By tables (See problem 4.)
3. By graphs

Key: Page 264 **1.** 1945: 600 babies; 1955: 800 babies. **2.** 1950: 3500 pupils, 1952: 4250 pupils, 1954: 5000 pupils, 1956: 5250 pupils; 250 pupils.

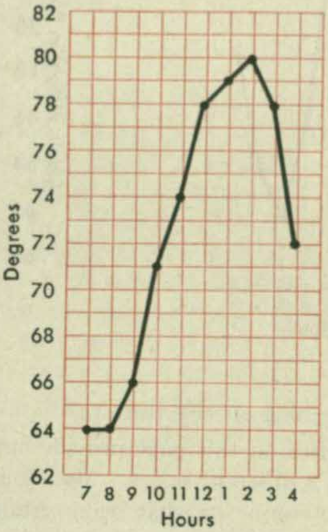
Page 265 **1.**



2.

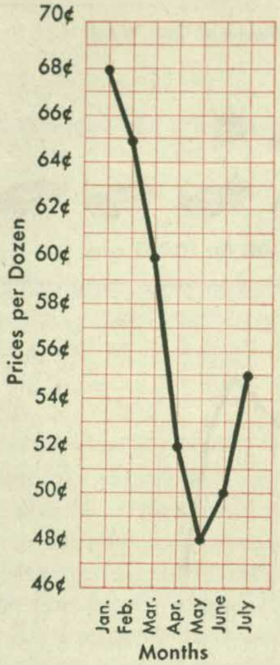


4.

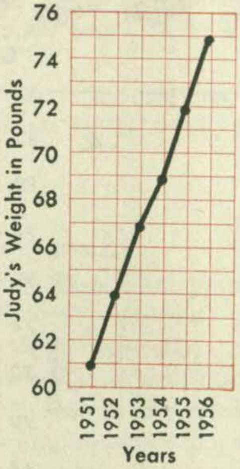


(a) 2 P.M.; (b) between 9 A.M. and 10 A.M.; (c) between 3 P.M. and 4 P.M.; (d) between 7 A.M. and 8 A.M.

5.



6.



Page 266

Aim: To extend the teaching of scale drawings

Suggestions: The exercises on this page provide opportunities for the pupils to draw a tennis court to 3 different scales. Also, suggest that pupils search their geography books to determine to what scale certain maps are drawn. A scale map of the community or school property might be constructed by the class.

Key: **1.** 78 ft.; $4\frac{7}{8}$ in.; $1\frac{11}{16}$ in. **2.** (1) $78 \times \frac{1}{8}$ in. $= \frac{78}{8}$ in., or $9\frac{3}{4}$ in.; (2) $27 \times \frac{1}{8}$ in. $= \frac{27}{8}$ in., or $3\frac{3}{8}$ in.; (3) $21 \times \frac{1}{8}$ in. $= \frac{21}{8}$ in., or $2\frac{5}{8}$ in.; (4) $18 \times \frac{1}{8}$ in. $= \frac{18}{8}$ in., or $2\frac{1}{4}$ in.; (5) $13\frac{1}{2} \times \frac{1}{8}$ in. $= \frac{27}{16}$ in., or $1\frac{11}{16}$ in. **3.** (1) $78 \times \frac{1}{4}$ in. $= \frac{78}{4}$ in., or $19\frac{1}{2}$ in.; (2) $27 \times \frac{1}{4}$ in. $= \frac{27}{4}$ in., or $6\frac{3}{4}$ in.; (3) $21 \times \frac{1}{4}$ in. $= \frac{21}{4}$ in., or $5\frac{1}{4}$ in.; (4) $18 \times \frac{1}{4}$ in. $= \frac{18}{4}$ in., or $4\frac{1}{2}$ in.; (5) $13\frac{1}{2} \times \frac{1}{4}$ in. $= \frac{27}{8}$ in., or $3\frac{3}{8}$ in.

Page 267

Aim: To review the solving of problems mingling common and decimal fractions

Workbook Reference: Arithmetic Workshop, Book 6, pages 99 and 105

Key: **1.** \$24.10 − \$8.75 = \$15.35. **2.** 12 ÷ 3 = 4 (times); 4 × \$.25 = \$1.00. **3.** $\frac{500}{2000} = \frac{1}{4}$ (T.); $\frac{1200}{2000} = \frac{3}{5}$ (T.). **4.** $2\frac{1}{2} \div \frac{1}{4} = 10$ (times); 10 × 5 mi. = 50 mi. **5.** \$162.70 ÷ 583 = about \$.28. **6.** 24 boys $\div \frac{3}{4} =$ 32 boys. **7.** 811 + 806 + 808 + 802 = 3227 (mi.); 3227 mi. ÷ 4 = $806\frac{3}{4}$ mi. **8.** 699 + 709 + 698 + 707 = 2813 (mi.); 2813 mi. ÷ 4 = $703\frac{1}{4}$ mi. **9.** 606 mi. ÷ 60 = 10.1 mi. **10.** $6\frac{1}{6}$ hr. **11.** $1\frac{1}{2} \times 2\frac{3}{4} \times \frac{2}{3} = 2\frac{3}{4}$ (cu. ft.).

Page 268

Aim: To review the major aims of Chapter 7

Suggestions: This review tests 7 of the 11 major aims of Chapter 7 as set forth in this Guide at the beginning of the chapter. These are:

Chapter Review	*Aim Number*
Ex. 1	2
Ex. 2 and 7	3
Ex. 3	6
Ex. 4	10
Ex. 5 and 6	5
Ex. 8	7
Ex. 9–11	9

Key: **1.** 16 × $\frac{1}{4}$ in. = 4 in., 22 × $\frac{1}{4}$ in. = $5\frac{1}{2}$ in.; so the scale drawing will be 4 in. × $5\frac{1}{2}$ in. **3.** $2\frac{1}{4} \times 4\frac{1}{4} \times 2 = 19\frac{1}{8}$ (cu. ft.). **4.** $\frac{1}{8}$ of the length = $1\frac{1}{4}$ in.; $\frac{8}{8}$ of the length = 10 in. **5.** (1) 2 × 1728 cu. in. = 3456 cu. in.; (2) $3\frac{1}{2}$ × 1728 cu. in. = 6048 cu. in.; (3) $2\frac{1}{4}$ × 1728 cu. in. = 3888 cu. in. **6.** (1) 81 cu. ft. ÷ 27 cu. ft. = 3 (cu. yd.); (2) 108 cu. ft. ÷ 27 cu. ft. = 4 (cu. yd.); (3) 135 cu. ft. ÷ 27 cu. ft. = 5 (cu. yd.). **7.** 3 × \$.98 = \$2.94, 6 × \$.49 = \$2.94, 7 × \$.23 = \$1.61; \$2.94 + \$2.94 + \$1.61 = \$7.49. **8.** 22 × 14 × 9 = 2772 (cu. in.); 2772 cu. in. ÷ 231 cu. in. = 12 (gal.). **9.** 12 hr. 85 min., or 13 hr. 25 min.; 44 ft. 24 in., or 46 ft.; 14 lb. 35 oz., or 16 lb. 3 oz. **10.** (1) 4 min. 70 sec. − 1 min. 25 sec. = 3 min. 45 sec.; (2) 8 yd. 36 in. − 4 yd. 9 in. = 4 yd. 27 in.; (3) 6 ft. 15 in. − 2 ft. 7 in. = 4 ft. 8 in. **11.** (1) 7 gal. 4 qt. − 2 gal. 3 qt. = 5 gal. 1 qt.; (2) 4 bu. 1 pk.; (3) 8 lb. 20 oz. − 2 lb. 7 oz. = 6 lb. 13 oz.

Page 269

Aim: To present Problem Test 7

Suggestion: Be sure to remind the pupils to graph their scores on their individual bar graphs.

Workbook Reference: Arithmetic Workshop, Book 6, page 113

Key: **1.** 15 × 16 mi. = 240 mi. **2.** If $\frac{3}{4}$ yd. costs 45¢, $\frac{1}{4}$ yd. costs 45¢ ÷ 3, or 15¢, and $\frac{4}{4}$ yd. costs 4 × 15¢, or 60¢. **3.** 1 lb. = 16 oz., 16 oz. ÷ 2 oz. = 8; 8 × 10¢ = 80¢. **4.** 7.76 in. + 3.92 in. + 3.83 in. + 2.68 in. + .45 in. + 3.88 in. + 3.18 in. + 2.90 in. + 1.43 in. + 1.68 in. + .92 in. + 4.33 in. = 36.96 in.; 36.96 in. ÷ 12 = 3.08 in. **5.** 1070 mi. ÷ 3.5 = about 306 mi. **6.** 200 ft. + 240 ft. + 200 ft. + 240 ft. = 880 ft.; $\frac{880}{5280} = \frac{1}{6}$ (mi.). **7.** \$375 ÷ \$25 = 15 (times). **8.** 60 × 30 × 6 = 10,800 (cu. ft.). **9.** \$.83 + \$2.79 + \$2.35 = \$5.97. **10.** \$1.35 − \$.55 = \$.80; \$24 ÷ \$.80 = 30 (wk.).

Page 270

Aim: To give a diagnostic test on areas, volumes, and measures, with page references for remedial work

Key: **1.** (1) 2400 sq. ft.; (2) $4 \times 8\frac{1}{2} = 34$ (sq. ft.). **2.** (1) 1050 sq. yd.; (2) $6 \times 7\frac{2}{3} = 46$ (sq. ft.). **3.** (1) 120 cu. in.; (2) 80 cu. in. **4.** (1) $4 \times 8 \times 1\frac{1}{2} = 48$ (cu. ft.); (2) $\frac{1}{2} \times 4 \times 3 = 6$ (cu. ft.). **5.** 432; $\frac{1}{4}$. **6.** 36; $\frac{2}{3}$. **7.** 54; $\frac{1}{3}$. **8.** 5184; 3. **9.** $3 \times 4 = 12$ (sq. yd.); $12 \times \$4.50 = \$54.00$. **10.** $6'' \times 7'' \times 11'' = 462$ cu. in.; 462 cu. in. ÷ 231 cu. in. = 2 (gal.). **11.** 16 lb. 22 oz., or 17 lb. 6 oz.; 17 yd. 5 ft., or 18 yd. 2 ft.; 13 ft. 20 in., or 14 ft. 8 in. **12.** (1) 6 hr. 91 min. − 2 hr. 55 min. = 4 hr. 36 min.; (2) 6 qt. 2 pt. − 4 qt. 1 pt. = 2 qt. 1 pt.; (3) 3 bu. 4 pk. − 2 bu. 2 pk. = 1 bu. 2 pk.

Chapter 8

Aims of Chapter 8. The major aims of Chapter 8 are to:

1. Teach the meaning of per cent.
2. Teach the reading and writing of per cents.
3. Teach the finding of an easy per cent of a number.
4. Teach rounding off answers to the nearest cent when finding a per cent of a given number of dollars and cents.
5. Teach simple discount and the special vocabulary of discount.
6. Enrich the mathematical experiences of pupils with appreciation units on time and savings accounts.
7. Provide the pupils with ample review material on all important understandings and skills taught in Chapters 2 through 7.
8. Suggest a variety of practice exercises in basic skills.

Many teachers will use this chapter as a ready means for individualized pupil instruction prior to taking the end-of-year tests. The following pages contain excellent end-of-year testing suggestions:

Pages 278–279 — Comprehension of large numbers
Page 295 — Placement of the decimal point in products and quotients
Page 299 — Division of large numbers
Pages 287, 289, and 296 — Problem solving

The Teaching of Percentage. From the standpoint of computation, the subject of percentage is merely another application of decimals. Thus there are no new operations to be learned as there are in a subject like common fractions. The knowledge of decimals which the pupil has already acquired will serve all his needs in percentage. In fact, most of the actual work that the pupil will do in percentage will involve easier computation with decimals than much of that which he has already done.

From the standpoint of language, however, percentage is *entirely new*. In fact, the teaching of percentage is largely a series of language lessons. Percentage is new also with respect to its symbolism; that is, with respect to its method of expressing *hundredths* by means of the symbol %. Success in percentage requires that the pupil fully appreciate the fact that 37% is merely another way of writing .37 or $\frac{37}{100}$. Whenever a pupil sees 37%, he must understand that he can substitute .37 for it. Likewise, when he sees .37, he must be able to change it to 37%. The ability to make this rapid change from a decimal representing *hundredths* to the per cent symbolism, and vice versa, is one of the important skills that must be acquired early in the study of percentage.

In teaching percentage you must clearly understand that your task is not to teach pupils to *compute* with decimals that represent per cents. You must teach them to *interpret* per cents and to understand their significance. Such interpretations are frequently necessary in situations where no computation at all is required. For example, in reading a newspaper you are often required to interpret a statement such as "All goods are to be sold at 25% off" or "The population has increased 5%"; yet in these instances you make no computations. In fact, for most people, percentage is usually applied in *interpreting* what they read.

Pages 271–272

Aim: To understand the 24-hour clock

Suggestions: The 24-hour clock is the official time system for our Army, Navy, and Air Force. It is also used extensively in Europe and in listing time schedules for overseas air flights. Our present 12-hour clock goes back many years in history. When we go back far enough in ancient history, we find that for countless thousands of years the only time known was either "day" or "night." Man worked during the daylight hours and slept during the hours of darkness. Then came early clock inventions: the sundial, the water clock, the hourglass, and shadow reckoning. Man wanted to divide time into smaller parts; so, finally the 12-hour day and the 12-hour night were decided upon. To us have come down the 12-hour period starting with midnight and continuing until noon and the 12-hour period from noon to midnight. This two-part day forces the calculator to write A.M. or P.M. after his time measure. Finally, one 24-hour period was proposed; it eliminated A.M. and P.M. by starting with midnight and counting until the next midnight. Thus, noon became 1200 and 6 o'clock at night became 1800. It is believed that system of keeping time will become more popular. Some teachers encourage pupils to talk in terms of the 24-hour clock in referring to their school and home appointments. Pupils who have had relatives in the service may be able to bring to school collections of items showing records based on the 24-hour clock.

While a discussion of the 24-hour clock is being held, some boys and girls may wish to tell about the Navy system of bells and to explain what 6 bells means, what 4 bells means, and so on.

Key: Page 271 **1.** 3:15 P.M. **2.** 1800; 0730; 1306. **3.** 1528.

Page 272 **3.** 1200. **4.** 0420; 1830; 1000; 1750; 1105; 0315; 2300; 0045. **5.** 7:49 A.M.; 7:15 P.M.; 9:03 A.M.; 12:26 A.M.; 5 P.M.; 10:30 P.M.; 10:00 A.M.; 7:55 P.M. **6.** 12 hr. 30 min. **7.** 12 hr. 26 min.; 12 hr. 35 min. **8.** 12 hr. 40 min.; 53 hr. 15 min. **9.** 10:55 P.M.

Pages 273–274

Aim: To teach the meaning of per cent and the language peculiar to percentage

Suggestions: The meaning of percentage is explained in ex. 1 on page 273. It should be made clear to the pupils that 57% is merely a new way of writing $\frac{57}{100}$ or .57. Likewise, 3% is a new way of writing $\frac{3}{100}$ or .03. It will be well for you to write on the board the four different ways of writing a per cent like

57%. These ways are as follows: $\frac{57}{100} = .57 = 57\% = 57$ per cent. Make clear to the pupils that any one of the four expressions may be exchanged for another. In this connection ex. 3 and 4 on page 273 are important. You should remember that any new method of writing or expressing a number becomes familiar to the pupil only by much practice in using it. Ex. 6–10 on page 273 represent informational uses of per cent. On page 274 the meaning of per cent is further illustrated through diagrams in which large squares are divided into 100 small squares. More work on diagrams of per cents may be assigned for a class exercise. Supply each pupil with a sheet of graph paper. Have the pupils mark off several large squares, each of which is 10 by 10 small squares. Ask them to color 15% of one large square green, 43% of another red, and so on.

Key: Page 273 **3.** 29%; 32%; 60%; 41%; 85%; 2%; 11%. **4.** 14%; 75%; 22%; 61%; 1%; 48%; 6%. **5.** .23; .95; .39; .01; .40; .09; .72.

Page 274 **1.** 1%. **2.** 5%; 95; 95%. **3.** 24%, 76%; 50%, 50%. **5.** 75%; 68%; 50%. **6.** 85%; 75%.

Page 275

Aim: To teach how to find a per cent of a number

Suggestions: On these pages the pupil learns that to find 35% of a number, he can change 35% to .35 and multiply the number by .35. This multiplication by a decimal is work he already knows how to do, so finding a per cent of a number becomes a very simple process.

Key: **2.** $105.20. **4.** .42; 63. **5.** .60; 288. **6.** .04; 12. **7.** 27; 28; 5; $78. **8.** 6; 24; 6; $57.50. **9.** 14; 6; 20; $35.20.

Page 276

Aim: To teach the meaning of 100% and its applications in everyday life

Suggestions: The expression "100%" is a good illustration of the language element in percentage. As ordinarily used, 100% is the equivalent of the word *all*. The pupils may be asked to bring to class illustrations of the use of 100% as given in ex. 8–13.

Page 277

Aim: To give a new set of improvement tests in subtraction

Suggestion: This set of improvement tests on subtraction should be administered in the same manner as previous sets.

Key: **1.** 212,415; 364,882; 81,828; 95,992. **2.** 291,974; 181,966; 547,064; 387,347. **3.** 18,235; 676,425; 79,736; 153,648. **4.** 143,705; 297,490; 470,369; 197,982. **5.** 80,588; 415,731; 366,783; 53,667. **6.** 364,565; 94,777; 348,029; 569,578. **7.** 112,552; 185,632; 44,695; 276,304. **8.** 81,842; 133,890; 33,474; 279,656. **9.** 153,289; 60,977; 169,428; 27,789.

Pages 278–279

Aim: To present problems dealing with New York City

Suggestions: Many persons are staggered by the large numbers used in a discussion of the greatest city in the world. In fact, the mere saying of these large numbers adds nothing to the meaningful experiences of the learner. The concept of 8 million people in problems 1 and 2 can be made more meaningful if comparisons are made. If there are 4 million people living in your state, you can indicate that there are twice as many people in New York City as in your entire state; if only 2 million people live in your state, there are four times as many in New York. If you live in a city of 80,000, you can indicate that for every person in your city, there are 100 people in New York City.

In problem 3, it is rather difficult for a rural child to appreciate a height of 102 stories. If your school is two stories high, say that if you pile 50 other school buildings on top of your school, the height would be 102 stories. Or, if there is a tall flagpole in the schoolyard, make a comparison with that.

In problem 9 the 824 schools in New York City might be the same number as the number of school children in your town and would mean that there would be one school for each child in your town.

Large numbers must be associated with things within the environment of the learner if an understanding of the number is to take place.

Key: **1.** 7,782,000; 7,780,000; 7,800,000; 8,000,000. **2.** 7,781,984 people ÷ 316 = about 24,626 people. **3.** (1) 1472 ft. − 222 ft. = 1250 ft.; (2) 1250 ft. ÷ 102 = 12.3 ft. **4.** 766 × .70 = 536.2 mi. **5.** 1,795,106,754 is about 1,795,107,000; 1,795,107,000 ÷ 12 = 149,592,250 (passengers). **6.** 6 × 4,411,982 = 26,471,892 (telephone calls). **7.** (1) 60 ÷ $3\frac{1}{3}$ = 18 (babies); (2) 24 × 18 = 432 (babies); (3) 365 × 432 = 157,680 (babies). **8.** 5 × 365 = 1825 (sets of twins). **9.** 963,495 ÷ 824 = $1169\frac{239}{824}$, or about 1169 (pupils).

Pages 280–281

Aim: To show how certain problems may be solved in two different ways

Suggestion: The model solutions in ex. 1 explain the nature of this work. The pupil should try to work each of the problems on these pages in two different ways.

Key: The solutions to ex. 2–16 are the shorter solutions. Longer solutions may be used if preferred. Sometimes the longer solutions seem simpler than the shorter ones. **2.** On one ball Henry saves $.87 − $.70, or $.17; on 5 balls he saves 5 × $.17, or $.85. **3.** In 1 hr. the fast train gains 52 mi. − 34 mi., or 18 mi.; in 3 hr. the fast train gains 3 × 18 mi., or 54 mi. **4.** In 5 wk. the difference in savings is $5.10 − $3.75, or $1.35; in 1 wk. the average difference is $1.35 ÷ 5, or $.27. **5.** For 1 stamp of each kind Frank pays 3¢ + 4¢, or 7¢; for 35 stamps of each kind he pays 35 × 7¢, or $2.45. **6.** The extra cost for 1 yd. is $1.95 − $1.69, or $.26; the extra cost for 4 yd. is 4 × $.26, or $1.04. **7.** Both boys sold

49 + 37, or 86 (tickets); both boys got 86 × $.45, or $38.70. **8.** Mrs. Page bought 8 cans + 5 cans, or 13 cans; the cost was 13 × $.29, or $3.77. **9.** The extra cost for 1 qt. of one kind is $.75 − $.59, or $.16; the extra cost for 6 qt. is 6 × $.16, or $.96. **10.** In 1 hr. the extra distance she goes by bicycle is 7 mi. − 3 mi., or 4 mi.; in $\frac{1}{2}$ hr. the extra distance is $\frac{1}{2}$ × 4 mi., or 2 mi. **11.** The present for 1 boy costs $3.75 + $5.00, or $8.75; the presents for 4 boys cost 4 × $8.75, or $35.00. **12.** The extra cost of 3 large handkerchiefs is $1.29 − $.96, or $.33; the extra cost of 1 large one is $.33 ÷ 3 = $.11. **13.** 1 ball of the cheaper kind costs $.81 − $.68, or $.13, less; 8 balls cost 8 × $.13, or $1.04, less. **14.** The difference in cost of 1 tire is $27.40 − $22.90, or $4.50; the difference in cost of 4 tires is 4 × $4.50, of $18.00. **15.** The difference in cost of 1 doz. balls is $9.60 − $7.80, or $1.80; the difference in cost of 1 ball is $1.80 ÷ 12, or $.15. **16.** One book cost $2.29 − $1.75, or $.54, less; 9 books cost 9 × $.54, or $4.86, less.

Page 282

Aim: To provide an end-of-year test on common fractions

Workbook Reference: Arithmetic Workshop, Book 6, page 116

Key: **1.** $1\frac{7}{8}$ yd. + $2\frac{1}{2}$ yd. + $1\frac{1}{4}$ yd. = $5\frac{5}{8}$ yd. **2.** 5 lb. − $1\frac{1}{2}$ lb. = $3\frac{1}{2}$ lb. **3.** $9\frac{7}{8}$ in. + $15\frac{1}{4}$ in. + $9\frac{7}{8}$ in. + $15\frac{1}{4}$ in. = $50\frac{1}{4}$ in. **4.** $1\frac{1}{2}$; $9\frac{1}{2}$; $4\frac{1}{4}$; $13\frac{1}{16}$; $8\frac{7}{12}$; $10\frac{11}{12}$; $13\frac{1}{2}$. **5.** $\frac{3}{4}$; $11\frac{5}{8}$; $13\frac{1}{4}$; $6\frac{4}{5}$; $8\frac{7}{12}$; $5\frac{1}{12}$; $16\frac{1}{3}$. **6.** $\frac{3}{8}$; $4\frac{1}{4}$; $2\frac{2}{3}$; $3\frac{11}{12}$; $5\frac{3}{8}$; $\frac{3}{4}$; $2\frac{13}{16}$. **7.** $\frac{2}{5}$; $\frac{1}{2}$; 5; $3\frac{3}{16}$; $4\frac{5}{12}$; $\frac{7}{10}$; $5\frac{2}{5}$. **8.** $\frac{5}{16}$; $1\frac{1}{2}$; $6\frac{1}{4}$; 12. **9.** $\frac{7}{16}$; 9; 2; $172\frac{1}{2}$. **10.** 24; $\frac{3}{4}$; $\frac{8}{32}$; $3\frac{3}{8}$.

Page 283

Aim: To give further practice in the language of percentage

Suggestions: Problem 1 illustrates the desirability of rounding off answers to the nearest whole number. The necessity for rounding off answers to the nearest whole figure is obvious in ex. 2 and 3, since it is impossible to express these answers as 131.44 pupils or 104.75 Boy Scout members! It should be stressed that determining when and how to round off numbers is largely a matter of common sense. In ex. 4 point out that it is practical to round off the answer to the nearest tenth of a point because we are accustomed to dealing with pounds and fractions of pounds where small figures are involved. Similarly, emphasize that mileage is ordinarily expressed in fractional terms when dealing with such distances as given in ex. 5. In working with the large scale number presented in ex. 6, the pupil will readily understand why it is not necessary to express this answer precisely. He is already familiar with the meaning and application of statistics involving large round numbers which occur frequently throughout his social studies.

Key: **2.** 248 × .53 = 131.44, or about 131 (pupils). **3.** 419 × .25 = 104.75, or about 105 (new members). **4.** 17 × .92 = 15.64, or 15.6 (lb.). **5.** 791 × .18 = 142.38, or about 142.4 (miles). **6.** 46,900,000 × .30 = 14,070,000, or 14,100,000 (bales).

Pages 284–285

Aim: To give information on saving money, including the method of opening a savings account in a bank

Suggestions: The pupils should be made acquainted with deposit slips and deposit books. A typical deposit slip is shown on page 284. This form should be followed by the pupils in making out the deposit slips connected with the exercises on page 285.

Key: **4.** \$3.95. **5.** \$3.95 + \$1.35 + \$1.55 = \$6.85. **6.** \$6.85 + \$5.00 + \$1.50 = \$13.35. **7.** \$13.35 − \$2.75 = \$10.60.

Page 286

Aim: To present problems without numbers

Suggestions: Page 155 also gives problems of this type. *American Arithmetic, Grade 6*, provides a wide variety of problem-solving situations. Problems without numbers is one of these. Some of the others are (1) problems without questions, (2) problems involving extra facts, (3) problems with insufficient data, and (4) two-step and three-step problems with sufficient data and questions. Problem solving requires critical thinking. Problems without numbers are a more difficult type of problem. If pupils find difficulty in solving these problems, suggest that they supply numbers for each problem, solve it, then tell in general terms what they did. This material is excellent readiness work for problems in high school.

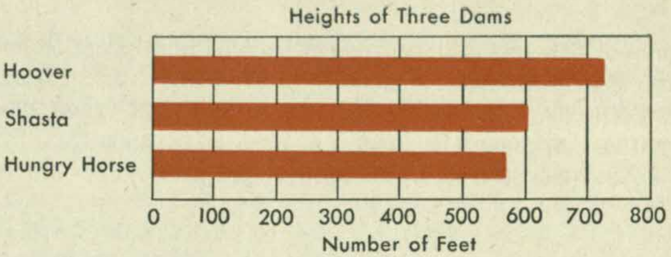
Key: **1.** Subtract. **2.** Divide. **3.** Add. **4.** Divide. **5.** Subtract. **6.** Multiply. **7.** Subtract. **8.** Divide. **9.** Divide. **10.** Multiply.

Page 287

Aim: To provide a test in problem solving

Suggestion: This is the fourth page in this chapter which may be used as an end-of-year test in problem solving.

Key: **1.** 2150 + 2475 = 4625 (boxes), 7385 − 4625 = 2760 (boxes); 2150 × 150 = 322,500 (oranges), 2475 × 176 = 435,600 (oranges), 2760 × 220 = 607,200 (oranges); 322,500 + 435,600 + 607,200 = 1,365,300 (oranges). **2.** 1,365,300 ÷ 12 = 113,775 (doz.). **3.** 500 mi. ÷ 32 = about 15.6 mi. **4.** 10 gal. + 10 gal. = 20 gal., 32 gal. − 20 gal. = 12 gal.; 10 × \$.289 = \$2.89, 10 × \$.326 = \$3.26, 12 × \$.295 = \$3.54; \$2.89 + \$3.26 + \$3.54 = \$9.69. **5.** (1) $2\frac{3}{4}$ in. ÷ $\frac{1}{8}$ in. = 22 (ft.); (2) $1\frac{7}{8}$ in. ÷ $\frac{1}{8}$ in. = 15 (ft.). **6.** 80 × 140 = 11,200 (sq. ft.), 75 × 150 = 11,250 (sq. ft.), 90 × 130 = 11,700 (sq. ft.); 11,700 sq. ft. − 11,200 sq. ft. = 500 sq. ft., 11,700 sq. ft. − 11,250 sq. ft. = 450 sq. ft. So the lot 90 ft. × 130 ft. is 500 sq. ft. larger than the 80 ft. × 140 ft. lot and 450 sq. ft. larger than the 75 ft. × 150 ft. lot. **7.** (1) 5 Saturdays; June 1, June 8, June 15, June 22, June 29; (2) 5 Sundays; (3) 4 Mondays; June 3, June 10, June 17, June 24. **8.** Let 726 ft. = about 725 ft.; 602 ft., about 600 ft.; 564 ft., about $566\frac{2}{3}$ ft.



Page 288

Aim: To show how the whole, or 100%, is made up of parts that total 100%.

Suggestion: Give considerable attention to work of this kind. Begin by giving problems such as "42% of this class are boys. What per cent are girls?" "53% of the pupils in a class had the flu. What per cent did not have the flu?" Then ask each pupil to make up one good problem of this kind.

Key: **2.** 25%. **3.** 45%. **4.** 85%. **5.** 25%. **6.** 55%. **7.** 91%. **8.** 5%. **9.** 13%.

Page 289

Aim: To review problem solving

Suggestions: The problems on this page will also make an excellent end-of-year test in problem solving because they include the following skills and understandings:

Three-step problem — problem 1
Bills of purchase — problem 11
Average costs — problems 4 and 12
Scale drawing — problem 2
Comparison of numbers — problem 6
Compound numbers — problem 7
Subtraction and multiplication of common fractions — problems 9 and 10

Key: **1.** \$2.40. **2.** 1 in. **3.** \$5.80. **4.** \$1945. **5.** 60 ft. **6.** $1\frac{1}{4}$ in.; $2\frac{1}{2}$ in. **7.** 20 da. **8.** \$.09. **9.** $3\frac{1}{4}$¢. **10.** \$81.25. **11.** \$4.65. **12.** \$.46$\frac{2}{3}$.

Page 290

Aim: To teach fractional equivalents of certain frequently used per cents

Suggestions: Page 290 gives practice in using 25%, 50%, 75%, and their equivalent fractions so that pupils can quickly learn to find these percentages mentally. Pupils soon realize why this page is called "short cuts." These short-cut equivalents should be learned because they will be used often.

Key: **2.** 10; 62; \$160. **3.** 23; 117; \$219. **5.** 200; 216; \$39. **6.** 358; 32; \$336. **7.** 123; 486; \$84. **8.** \$24. **9.** \$7.50. **10.** 180 pupils. **11.** \$271.

Page 291

Aim: To present new sets of improvement tests on multiplication and division

Key: **1.** 705,664; 1,114,485; 6,085,575; 1,978,918. **2.** 2,261,392; 785,152; 2,531,637; 1,501,632. **3.** 966,185; 1,117,788; 8,058,071; 2,987,325. **4.** 7283; 6900 R11; 8154. **5.** 5009 R19; 5763. **6.** 6395; 4718; 3800 R43. **7.** 6008 R11; 5279. **8.** 4592; 7086; 8600 R19. **9.** 5319; 7003 R3.

Page 292

Aim: To teach the rounding off of money numbers correct to the nearest cent

Suggestions: When the answer to a problem is a money number that contains more than two decimal places, such as $9.4825, it is customary to round off this money number correct to the nearest cent. This practice is explained on the first half of page 292. Notice that the figure to watch is the one in the third decimal place. The figures in the fourth and fifth decimal places do not affect the rounding off. Before assigning the written work on page 292, give some oral work on rounding off money numbers. Use these numbers to be rounded off to the nearest cent: $1.068; $3.799; $8.1253; $9.4989; $.7632; $.1960; $5.3125.

Key: **2.** $2.78; $4.48. **3.** $2.19; $5.53; $33.45. **4.** $2.01; $4.65; $11.28. **5.** $1.70; $17.50; $11.30. **6.** $2.05; $9.91; $6.93. **7.** $.95; $10.04; $13.19. **8.** $2.75; $9.10; $15.61. **9.** $3.55; $34.60; $36.36.

Page 293

Aim: To teach discount in the form in which it is used in retail stores, and terms peculiar to this topic

Suggestions: This page presents the subject of discount as it applies to the retail customer. In connection with this work, encourage the pupils to bring to class advertisements of sales on which discounts are allowed. You should have a folder of such advertisements in which you keep good examples of discount which you have found in newspapers and magazines.

Key: **2.** $2.25, $3.19; $6.75, $9.56. **3.** $6.50; $26.00. **4.** $117.26.

Page 294

Aim: To test arithmetic vocabulary

Key: **1.** Round number. **2.** Even number. **3.** Odd number. **4.** Area. **5.** Decimal; common. **6.** Fourth or quarter. **7.** Average. **8.** Rate or speed. **9.** Hundredths. **10.** Hundreds. **11.** Rounded off; nearest tenth. **12.** Rounded off; nearest hundredth. **13.** Billions. **15.** Deposit slip; teller.

Page 295

Aim: To review the placing of the decimal point in division and multiplication

Suggestions: This page concentrates on division and multiplication, with emphasis on the placement of the decimal point. If a pupil understands the controlling principle of the decimal point, he can work any examples in multiplication and division of decimal fractions provided he understands whole numbers. No time is wasted here on requiring pupils to enter into long computations. Placing the decimal point is the only understanding being measured. This is an excellent end-of-year test.

Key: **1.** 3.8; 740; 3900.; 56. **2.** 147.; 17.; 12.; 2.7. **3.** .73; 23.6; .07; .32. **4.** .07; 178.; .2; 480. **5.** .13; 11.5; 12,900.; 1700. **6.** 36.; 820.; 1.6; 8390. **7.** 2090.; .6; 4.7; 40,600. **8.** .07; 840.; 2.7; 5600. **9.** 45.76; 17.094. **10.** 5.547; 53.277. **11.** 2.025; 66.875. **12.** 954.8; 89.804. **13.** 8.928; 16.262. **14.** 37.406; 1429.64. **15.** 37.599; 587.084. **16.** 23.403; 1772.82.

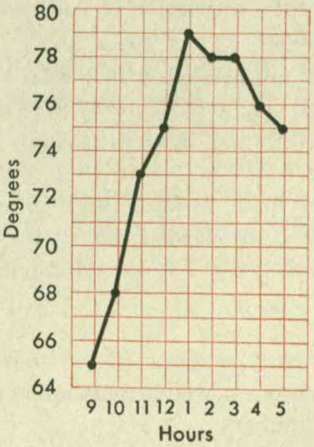
Page 296

Aim: To provide further word problems

Suggestions: If pupils have done poorly on the word problems found on pages 287 and 289, they should try these word problems. Some teachers assign a pupil-teacher to help another pupil with these problems, the pupil-teacher being drawn from those pupils who have already demonstrated an ability in problem solving.

Key: **1.** \$.50 + \$.15 = \$.65; 4 × \$.65 = \$2.60. **2.** \$1.78 ÷ 28 = about \$.06. **3.** \$9.35 + \$.25 = \$9.60, total cost; 25 lb. = 400 oz., 400 oz. ÷ 4 oz. = 100 (bags), 100 × \$.15 = \$15.00, total receipts; \$15.00 − \$9.60 = \$5.40, \$5.40 ÷ 2 = \$2.70. **4.** (1) 4 × 2 min. = 8 min.; (2) 60 min. ÷ 8 min. = $7\frac{1}{2}$ (mi.). **5.** (1) 10¢ is $\frac{1}{5}$ of 50¢, $\frac{1}{5}$ × 75 stamps = 15 stamps; (2) \$1.00 is twice 50¢, 2 × 75 stamps = 150 stamps; (3) 3 stamps is $\frac{1}{25}$ of 75 stamps, $\frac{1}{25}$ × 50¢ = 2¢.

6.



7. $1.15 + $.48 + $2.25 + $1.84 + $4.00 + $.60 + $5.25 + $.70 + $1.50 = $17.77; $2.65 + $8.32 + $.72 + $5.66 = $17.35; $17.77 − $17.35 = $.42.

Page 297

Aim: To provide mixed practice in common and decimal fractions, and whole numbers

Workbook Reference: Arithmetic Workshop, Book 6, page 117

Key: **1.** 700; 500; 900; 200; 700; 200. **2.** 4000; 3000; 7000; 5000; 8000; 4000. **3.** 4.2; 7.8; 3.3; 18.8; 34.7; 26.0. **4.** .92; .47; .91; 3.78; 5.10; 8.76. **6.** 109; 260; 245; 661; 1140; 1600; 1720; 1957. **7.** $1\frac{1}{2}$. **8.** $3\frac{1}{2} \times 8 = 28; 28 - 9\frac{1}{4} = 18\frac{3}{4}$. **9.** 15,622 + 18,428 + 17,905 + 24,077 = 76,032; 76,032 ÷ 4 = 19,008. **10.** 12.25 + 15.68 + 11.92 + 7.75 = 47.60; 47.60 ÷ 4 = 11.90. **11.** $2\frac{1}{2} + 1\frac{3}{4} + 3 + 4\frac{3}{8} + 4\frac{5}{8} + 3\frac{3}{4} = 20; 20 \div 6 = 3\frac{1}{3}$. **12.** $400 − $175.33 = $224.67. **13.** 29.6 − 21.9 = 7.7; 6.3 + 7.7 = 14.0. **14.** .9 × 6.5 = 5.85; 5.85 ÷ .05 = 117. **15.** $243 + $471 + $185 = $899; $1000 − $899 = $101.

16.

$$\begin{array}{rl} \$1.75 & \text{multiplicand} \\ \underline{\times 3} & \text{multiplier} \\ \$5.25 & \text{product} \end{array} \qquad \begin{array}{rl} \$8.27 & \text{minuend} \\ \underline{-1.89} & \text{subtrahend} \\ \$6.38 & \text{remainder} \end{array}$$

$$\begin{array}{rl} & \$1.76 \text{ quotient} \\ \text{divisor } 4 & \overline{)\$7.04} \text{ dividend} \end{array} \qquad \begin{array}{rl} \left.\begin{array}{r} \$215 \\ \underline{+198} \end{array}\right\} & \text{addends} \\ \$413 & \text{sum} \end{array}$$

Page 298

Aim: To review problem solving with problems which have extra facts

Suggestions: Problems similar to these are found on pages 81 and 190. See this Guide for page 286 for a discussion of various types of word problems.

Key: **1.** "$.325" not needed; 12 × $.295 = $3.54. **2.** "2 hr.," "2 used books," "3 errands," and "2 hr." not needed; $.75 + $.70 + $.95 + $.75 + $1.25 = $4.40. **3.** "$21\frac{1}{4}$ yd." not needed; $4\frac{1}{2}$ × $1.75 = 7.87\frac{1}{2}$, or $7.88. **4.** "120 doz." not needed; from 6:45 A.M. to 8 A.M. is $1\frac{1}{4}$ hr., 35 mi. ÷ $1\frac{1}{4}$ = 28 mi. **5.** "175 lb." and "89 lb." not needed; 6 ft. 2 in. − 4 ft. 10 in. = 5 ft. 14 in. − 4 ft. 10 in. = 1 ft. 4 in. **6.** "4 loaves," "$\frac{3}{4}$ lb.," "2 jars," and "2 jars" not needed; 96 − 8 = 88 (sandwiches). **7.** "$2\frac{1}{4}$¢" not needed; 25 × $3\frac{1}{2}$¢ = $87\frac{1}{2}$¢, or 88¢. **8.** "6 in. × 8 in. × 11 in." not needed; 6 × 7 × 11 = 462 (cu. in.); 462 cu. in. ÷ 231 cu. in. = 2 (gal.).

Page 299

Aim: To review long division in which remainders are expressed both as decimal fractions and as whole numbers

Suggestions: The decimal fraction is the most common way of writing remainders. Pupils may be reminded that if an answer will not come out evenly after it has been carried to two or three decimal places, a plus sign should be added at the end of the quotient. Naturally, answers may be taken to as many decimal places as the calculator wishes; but if a repeating decimal fraction occurs, there is no need to prolong the computation.

Key: **1.** Divisor; first; quotient. **2.** Divisor; more; first; quotient. **3.** 6.125; .625; 19.5; 7.32; 8.25. **4.** 14.5; .6; 11.8; 12.9; 19.4. **5.** 13.75; .375; 12.5; 6.48; 2.875. **6.** 17.67; .91; 5.17; 7.80; 1.35. **7.** 15.17; .76; 4.81; 9.58; 2.91. **8.** 8.33; .83; 6.79; 7.25; 3.43. **9.** 84 R15; 947; 83; 457 R211. **10.** 95 R18; 838 R25; 48 R5; 422. **11.** 92 R29; 956; 217; 619 R89. **12.** 283; 5728; 272 R191; 234 R152. **13.** 187 R3; 2060; 286 R103; 2007. **14.** 152; 2129; 76; 2200.

Page 300

Aim: To provide further practice in mental arithmetic

Key: **1.** 38, 45, 52, 59, 66, 73, 80, 87, 94; 110, 117, 124, 131, 138, 145, 152, 159, 166, 173. **2.** 14, 22, 30, 38, 46, 54, 62, 70, 78, 86; 95, 103, 111, 119, 127, 135, 143, 151. **3.** 50, 59, 68, 77, 86, 95, 104, 113, 122; 132, 141, 150, 159, 168, 177, 186, 195. **4.** 10 figures. **5.** 7,000,000,000. **6.** 1612; 1915; 1961. **7.** $3\frac{1}{4}$; $2\frac{4}{5}$; $3\frac{2}{3}$; $9\frac{1}{2}$; $2\frac{1}{3}$. **8.** $\frac{14}{3}$; $\frac{17}{2}$; $\frac{29}{4}$; $\frac{14}{5}$; $\frac{15}{8}$. **9.** $\frac{2}{5}$; $\frac{18}{25}$; $\frac{7}{100}$; $\frac{41}{1000}$; $\frac{9}{1000}$. **10.** .1; .17; .283; .09; .029. **11.** $\frac{2}{3}$; $\frac{2}{7}$; $\frac{5}{6}$; $\frac{7}{10}$; $\frac{1}{6}$. **12.** 5 lb. 13 oz. **13.** 25 oz.; 50 oz.; 39 oz. **14.** 29 in.; 50 in.; 47 in. **15.** 77 min.; 140 min. **16.** 14 qt.; 23 qt.; 37 qt. **17.** 60¢. **18.** 13¢. **19.** $\frac{1}{2}$ bu. **20.** $\frac{1}{10}$ T. **21.** 6. **22.** 80 mi.; 120 mi.; 20 mi.; 30 mi. **23.** 2 hr.; $\frac{1}{3}$ hr.; $1\frac{1}{3}$ hr.; $\frac{2}{3}$ hr.

Page 301

Aim: To present Problem Test 8

Suggestions: This is the last problem test in the book. Pupils will enjoy completing the bar graphs started with Problem Test 1 on page 41. The graphs can be mounted on heavy oaktag to become a part of the permanent record which the pupils take home at the end of the school year.

Key: **1.** 12 mi. ÷ $3\frac{3}{4}$ = $3\frac{1}{5}$ mi. **2.** $3\frac{1}{4}$ mi. ÷ $2\frac{1}{2}$ = $1\frac{3}{10}$ mi. **3.** \$26.35 − \$19.95 = \$6.40. **4.** \$18.75 × .20 = \$3.75; \$18.75 − \$3.75 = \$15.00. **5.** $\frac{3}{4}$ × \$3.50 = \$2.625, or \$2.63. **6.** 16.2 mi. + 26.5 mi. + 49.0 mi. + 18.2 mi. + 28.9 mi. + 30.7 mi. = 169.5 mi. **7.** \$134.86 + \$191.50 + \$153.25 = \$479.61; \$479.61 ÷ 3 = \$159.87. **8.** 189 ÷ 16 = 11 R13, or 12 (trips). **9.** 189 × \$.85 = \$160.65. **10.** \$5.00 ÷ \$.04 = 125 (ft.).

Pages 302–303

Aim: To provide diagnostic tests with page references for remedial work

Suggestions: These two pages correspond with pages 159–160. Many teachers will use the four pages for half-year and end-of-year tests.

Key: Page 302 **1.** $10\frac{7}{8}$; 16; $9\frac{5}{6}$; $10\frac{2}{5}$; $13\frac{7}{12}$. **2.** $5\frac{3}{4}$; $1\frac{1}{3}$; $6\frac{1}{16}$; $5\frac{3}{4}$; $2\frac{5}{6}$. **3.** $4\frac{3}{4}$; 18; $20\frac{5}{6}$. **4.** 42; 64; $38\frac{1}{4}$. **5.** $\frac{1}{16}$; $\frac{3}{4}$; $\frac{3}{4}$. **6.** $1\frac{7}{8}$; 1; $3\frac{3}{5}$. **7.** 14; 16; $13\frac{1}{2}$. **8.** $1\frac{3}{4}$; 3; $1\frac{1}{20}$. **9.** $\frac{3}{16}$; $\frac{1}{8}$; $\frac{3}{16}$. **10.** $\frac{4}{9}$; 4; 3. **11.** (1) 4 ft. × $6\frac{1}{4}$ ft. = 25 sq. ft.; (2) 3 ft. × $4\frac{1}{2}$ ft. = $13\frac{1}{2}$ sq. ft. **12.** (1) 18 cu. in.; (2) 4 ft. × 8 ft. × $1\frac{1}{3}$ ft. = $42\frac{2}{3}$ cu. ft.

Page 303 **1.** 28; 63; \$72.80. **2.** .6; .875; .44; .45; .03. **3.** .67; .44; .86; .18; .42. **4.** 86.48; 10.68; .063; 103.726. **5.** 4.5; 1.4; 6.8; 5. **6.** .07; 120; 400; .027. **7.** 37.4; 18.7; 24.9. **8.** 27; 148; 215. **9.** (1) 45 ft. 17 in., or 46 ft. 5 in.; (2) 20 bu. 6 pk., or 21 bu. 2 pk.; (3) 24 lb. 25 oz., or 25 lb. 9 oz. **10.** (1) 14 ft. 14 in. − 6 ft. 8 in. = 8 ft. 6 in.; (2) 8 qt. 2 pt. − 3 qt. 1 pt. = 5 qt. 1 pt.; (3) 6 hr. 60 min. − 2 hr. 34 min. = 4 hr. 26 min.

Page 304

Aim: To test readiness for Grade 7

Key: **1.** For the answers to the facts on pages 6, 11, and 22, see the Key for those pages; for the multiplication facts on page 6, see ex. 1 on page 15. **2.** $208\frac{1}{3}$; 4930.7; $26\frac{1}{4}$. **3.** $5\frac{7}{8}$; $826\frac{1}{9}$; 27. **4.** 2,613,468; $15\frac{5}{12}$; $5\frac{1}{4}$. **5.** 304.184; 3.64; $1\frac{5}{6}$. **6.** 58.4; 2393.27; $2\frac{3}{8}$. **7.** $\frac{3}{4}$; 80. **8.** 7920; 288. **9.** $1\frac{1}{2}$; 81. **10.** 6000; 132. **11.** 3296 + 3319 + 3285 + 3304 = 13,204; 13,204 ÷ 4 = 3301. **12.** 133 mi. ÷ $3\frac{1}{2}$ = 38 mi. **13.** (1) 150 ft. + 210 ft. + 150 ft. + 210 ft. = 720 ft.; (2) 150 × 210 = 31,500 (sq. ft.). **14.** $1\frac{1}{2}$ doz. = 18; 18 ÷ 3 = 6 (times); 6 × 10¢ = 60¢. **15.** (1) 4 × 2 × 5 = 40 (cu. in.), 3 × 2 × 7 = 42 (cu. in.), so the second box is larger in volume; (2) 42 cu. in. − 40 cu. in. = 2 cu. in.

Page 305

Aim: To present a ready-reference page of tables of measures

Pages 306–309

Aim: To provide a ready reference of basic addition, subtraction, multiplication, and division facts

Pages 310–326

Aim: To present additional practice pages

Key: Page 310 **1.** 230; 1593; 2239; 3000; 3006; 5784; 5290. **2.** 245; 2332; 2596; 2483; 2000; 11,861; 12,120. **3.** 82; 30; 46; 64; 20. **4.** 54; 85; 23; 61; 32. **5.** 43; 67; 27; 88; 54. **6.** 18; 342; 53; 36; 337; 858; 1148. **7.** 12; 323; 47; 279; 75; 2916; 598. **8.** 6; 245; 76; 189; 32; 4669; 996. **9.** 64; 729; 85; 524; 175; 186; 109. **10.** 1296; 3145; 8648; 6887; 1479. **11.** 960; 1752; 1360; 4648; 8460. **12.** 944; 4032; 4560; 2485; 3139. **13.** 703; 5330; 7470; 2914; 5796.

Page 311 **1.** 7440; 354,900; 307,680; 562,107. **2.** 2000; 285,760; 46,545; 18,750. **3.** 6240; 87,500; 572,460; 32,445. **4.** 4860; 99,902; 195,472; 178,200. **5.** 3010; 98,260; 214,500; 205,393. **6.** 1 R2; 8 R2; 4 R1; 4 R5; 3 R4; 8 R7; 6 R3. **7.** 0 R4; 8 R4; 2 R3; 7 R5; 6 R7; 7 R3; 4 R3. **8.** 2 R1; 2 R3; 5 R3; 6 R6; 6 R2; 8 R2; 5 R4. **9.** 0 R5; 7 R3; 8 R4; 3 R3; 7 R3; 3 R7; 9 R1. **10.** 1 R1; 7 R6; 8 R2; 9 R1; 3 R5; 6 R6; 9 R5. **11.** 0 R3; 9 R5; 5 R6; 6 R1; 8 R4; 5 R1; 3 R3. **12.** 2 R1; 9 R4; 2 R5; 2 R3; 4 R5; 4 R3; 3 R1. **13.** 4 R1; 8 R5; 5 R5; 9 R2; 4 R8; 3 R4; 9 R1. **14.** 368; 105; 654; 853; 5367 R4. **15.** 269; 163 R5; 907 R3; 685; 4582. **16.** 189; 124 R7; 640 R4; 871 R3; 1985. **17.** 197 R2; 409 R1;

389 R4; 457; 5097 R4. **18.** 138 R2; 148; 934; 509; 6418. **19.** 287; 69 R2; 709; 819; 3070 R2.

Page 312 **1.** $25\frac{1}{3}$; $198\frac{1}{4}$; 846; 750; $935\frac{5}{7}$. **2.** $32\frac{1}{2}$; $218\frac{1}{3}$; 728; 563; 769. **3.** $17\frac{3}{5}$; $292\frac{1}{2}$; 874; $593\frac{4}{5}$; $608\frac{7}{8}$. **4.** $23\frac{3}{4}$; $149\frac{1}{6}$; 497; 692; $807\frac{5}{9}$. **5.** $29\frac{2}{3}$; $152\frac{2}{5}$; 429; $563\frac{5}{6}$; 268. **6.** $13\frac{4}{5}$; 94; 508; 558; $273\frac{5}{6}$. **7.** 64; 72; 217; 354. **8.** 72; 86; 91 R37; 845. **9.** 43; 465; 26 R13; 865 R4. **10.** 54 R1; 74 R15; 71; 423. **11.** 63; 35; 65; 524. **12.** 57; 37; 42; 816. **13.** 292 R29; 44; 49; 876. **14.** 184 R12; 57 R18; 81 R31; 677. **15.** 57 R19; 57 R11; 97; 563. **16.** 57; 187; 78 R20; 837 R9. **17.** 91; 78 R15; 57 R7; 767 R7. **18.** 75; 63 R19; 47; 577.

Page 313 **1.** 29 R23; 99 R13; 65 R24; 277 R28. **2.** 245 R16; 63 R26; 67 R19; 685 R11. **3.** 47 R28; 62 R15; 57 R28; 335 R18. **4.** 94 R62; 45 R24; 36 R24; 297 R29. **5.** 75 R19; 67 R43; 67 R31; 743 R23. **6.** 75 R10; 218 R26; 56 R42; 423 R10. **7.** 56 R11; 235 R21; 18 R40; 459 R27. **8.** 73 R10; 73 R9; 53 R6; 864 R14. **9.** 42; 36; 82; 426 R7. **10.** 91 R10; 42; 94; 596. **11.** 92; 65; 72; 743 R8. **12.** 75; 83; 32 R5; 532. **13.** 82; 62; 62; 362. **14.** 56 R3; 52; 95; 656. **15.** 72; 72 R3; 82; 826. **16.** 85; 63; 62; 534. **17.** 63; 84; 82; 653. **18.** 62; 81; 74; 624. **19.** 38; 64; 72; 735.

Page 314 **1.** 9155; 17,312; 14,797; 23,285; 10,506; 11,201. **2.** 12,808; 12,010; 19,000; 15,217; 25,652; 13,172. **3.** 27,242; 13,738; 9750; 16,864; 30,564. **4.** 14,319; 18,399; 7667; 8275; 9885. **5.** 49,432; 55,813; 8424; 11,046; 8690. **6.** $5\frac{5}{8}$; $8\frac{1}{10}$; $11\frac{1}{8}$; $7\frac{9}{16}$; $10\frac{3}{16}$; $5\frac{1}{12}$; $6\frac{1}{2}$. **7.** $8\frac{1}{2}$; $9\frac{1}{6}$; $6\frac{3}{4}$; $13\frac{2}{3}$; $6\frac{9}{10}$; $9\frac{11}{16}$; $9\frac{1}{3}$. **8.** $9\frac{3}{4}$; $7\frac{7}{8}$; $5\frac{1}{2}$; $7\frac{1}{5}$; $8\frac{11}{12}$; $6\frac{4}{5}$; $9\frac{5}{16}$. **9.** $6\frac{2}{3}$; 8; $4\frac{1}{10}$; $13\frac{15}{16}$; $9\frac{4}{5}$; $8\frac{5}{12}$; $7\frac{7}{10}$.

Page 315 **1.** $4\frac{1}{3}$; $3\frac{5}{8}$; $2\frac{2}{3}$; $\frac{2}{5}$; $5\frac{7}{16}$; $1\frac{1}{4}$; $\frac{1}{2}$. **2.** $6\frac{1}{6}$; $\frac{3}{10}$; $2\frac{1}{4}$; $\frac{3}{8}$; $8\frac{1}{2}$; $\frac{7}{16}$; $5\frac{1}{2}$. **3.** 2; $7\frac{3}{4}$; $4\frac{1}{12}$; $5\frac{1}{6}$; $1\frac{5}{16}$; $4\frac{3}{5}$; $4\frac{1}{5}$. **4.** $4\frac{2}{3}$; $7\frac{1}{8}$; $2\frac{1}{3}$; $\frac{3}{10}$; $1\frac{1}{4}$; $5\frac{5}{16}$; $6\frac{7}{12}$. **5.** 8; 3; 21; 14. **6.** 4; 5; 19; 2, 8. **7.** 6; 5; 13; 2, 18. **8.** 3; 9; 23; 9, 21. **9.** 5; 9; 29; 6, 16. **10.** $4\frac{3}{4}$; $\frac{3}{8}$; $6\frac{1}{3}$; $4\frac{1}{4}$; $\frac{3}{8}$; $2\frac{3}{10}$; $2\frac{5}{6}$. **11.** $2\frac{4}{5}$; $5\frac{1}{4}$; $6\frac{2}{3}$; $3\frac{1}{2}$; $2\frac{2}{3}$; $1\frac{5}{8}$; $4\frac{1}{5}$. **12.** $\frac{1}{2}$; $4\frac{1}{3}$; $1\frac{1}{2}$; $4\frac{5}{8}$; $4\frac{3}{5}$; $5\frac{1}{6}$; $1\frac{3}{8}$.

Page 316 **1.** $4\frac{1}{10}$; $\frac{11}{12}$; $3\frac{13}{24}$; $2\frac{3}{5}$. **2.** $1\frac{1}{2}$; $7\frac{1}{4}$; $5\frac{3}{4}$; $2\frac{15}{16}$. **3.** $\frac{5}{12}$; $2\frac{4}{5}$; $10\frac{1}{2}$; $7\frac{3}{4}$. **4.** $7\frac{5}{12}$; $8\frac{11}{16}$; $5\frac{2}{3}$; $1\frac{3}{10}$. **5.** $9\frac{1}{12}$; $2\frac{13}{16}$; $7\frac{2}{3}$; $10\frac{11}{24}$. **6.** $3\frac{3}{4}$; $7\frac{11}{12}$; $8\frac{5}{8}$; $1\frac{9}{16}$. **7.** 33; 145; 46; 375. **8.** 128; 84; 51; 366. **9.** 69; 70; 87; 332. **10.** 330; 26; 65; 568. **11.** 77; 108; 99; 186. **12.** 72; 92; 135; 255. **13.** $22\frac{1}{2}$; $66\frac{1}{2}$; $67\frac{1}{2}$; $71\frac{1}{2}$. **14.** $32\frac{2}{3}$; $24\frac{3}{4}$; $9\frac{1}{3}$; $38\frac{1}{4}$. **15.** $62\frac{1}{2}$; $109\frac{3}{8}$; $22\frac{1}{2}$; $49\frac{1}{2}$. **16.** $18\frac{3}{4}$; $71\frac{1}{2}$; $26\frac{2}{3}$; $110\frac{1}{2}$. **17.** $157\frac{1}{2}$; $29\frac{3}{4}$; $14\frac{7}{8}$; $41\frac{1}{4}$. **18.** $13\frac{1}{5}$; $21\frac{1}{8}$; $15\frac{5}{6}$; $96\frac{3}{5}$. **19.** $34\frac{2}{3}$; $26\frac{2}{5}$; $26\frac{5}{6}$; $52\frac{1}{2}$. **20.** $42\frac{1}{2}$; $26\frac{2}{3}$; $30\frac{2}{5}$; $72\frac{1}{2}$.

Page 317 **1.** $9\frac{1}{3}$; $13\frac{1}{5}$; $52\frac{1}{2}$; 196. **2.** 27; 42; $44\frac{1}{4}$; $177\frac{1}{2}$. **3.** $18\frac{1}{8}$; $26\frac{2}{3}$; $201\frac{1}{3}$; 411. **4.** $16\frac{1}{2}$; $23\frac{1}{4}$; 141; $201\frac{3}{5}$. **5.** $7\frac{1}{3}$; $8\frac{2}{5}$; 129; $294\frac{3}{4}$. **6.** $23\frac{1}{3}$; $28\frac{1}{2}$; $65\frac{1}{3}$; $186\frac{2}{3}$. **7.** $\frac{2}{15}$; $2\frac{1}{4}$; $1\frac{1}{2}$; $10\frac{1}{2}$; $\frac{3}{20}$. **8.** $3\frac{3}{4}$; $5\frac{1}{4}$; $1\frac{1}{2}$; $\frac{1}{4}$; $2\frac{2}{5}$. **9.** $7\frac{1}{2}$; $4\frac{1}{2}$; $6\frac{2}{3}$; $12\frac{1}{2}$; $\frac{6}{25}$. **10.** $1\frac{1}{3}$; $3\frac{1}{3}$; $5\frac{1}{4}$; $4\frac{1}{5}$; $8\frac{1}{3}$. **11.** $2\frac{1}{4}$; $\frac{2}{3}$; $1\frac{1}{2}$; $\frac{2}{25}$; $\frac{3}{4}$. **12.** $1\frac{1}{2}$; $\frac{3}{14}$; $\frac{20}{27}$; $\frac{3}{5}$; $\frac{5}{32}$. **13.** $3\frac{1}{3}$; 1; 15; $6\frac{1}{4}$. **14.** $1\frac{1}{3}$; 6; $2\frac{1}{4}$; 3. **15.** $\frac{9}{10}$; $1\frac{2}{3}$; 6; $1\frac{1}{2}$. **16.** 1; $3\frac{1}{2}$; 6; 10. **17.** $1\frac{1}{2}$; 3; $1\frac{1}{2}$; $\frac{1}{2}$. **18.** $1\frac{1}{4}$; $2\frac{7}{10}$; $2\frac{3}{16}$; $7\frac{1}{2}$. **19.** $2\frac{2}{3}$; 3; 14; $\frac{7}{10}$.

Page 318 **1.** $\frac{2}{5}$; $\frac{4}{25}$; $\frac{18}{25}$; $\frac{19}{20}$; $\frac{3}{8}$; $\frac{9}{40}$; $\frac{19}{40}$. **2.** $\frac{3}{4}$; $\frac{9}{20}$; $\frac{7}{50}$; $\frac{21}{25}$; $\frac{3}{20}$; $\frac{31}{40}$; $\frac{1}{2}$. **3.** $\frac{12}{25}$; $\frac{4}{5}$; $\frac{14}{25}$; $\frac{23}{25}$; $\frac{1}{8}$; $\frac{7}{20}$; $\frac{23}{40}$. **4.** $\frac{7}{10}$; $\frac{24}{25}$; $\frac{1}{10}$; $\frac{16}{25}$; $\frac{27}{40}$; $\frac{33}{40}$; $\frac{17}{20}$. **5.** 892,982; 4,604,250; 2,588,760 **6.** 4,058,535; 1,638,630; 2,590,980. **7.** 2,418,032; 1,099,680; 1,326,927. **8.** 1,064,692; 2,184,480; 346,188. **9.** 25.8; .81; .114; 25.5. **10.** 16.2; .48; 1.206; 1.68. **11.** 31.5; 1.16; .028; 1.44. **12.** 17.5; .96; .018; .98. **13.** 79.52; 76.88;

25.653; 16.416. **14.** 64.26; 8.652; 84.165; 36.982. **15.** 64.66; 30.295; 58.302; 36.868. **16.** 326.43; 407.68; 18.564; 55.292. **17.** $\frac{3}{16}$; $\frac{9}{16}$; $\frac{5}{16}$; $\frac{1}{3}$; $\frac{8}{15}$; $\frac{5}{7}$; $\frac{4}{7}$; $\frac{2}{3}$. **18.** $\frac{1}{3}$; $\frac{2}{5}$; $\frac{1}{5}$; $\frac{8}{11}$; $\frac{17}{25}$; $\frac{1}{4}$; $\frac{7}{12}$; $\frac{7}{12}$.

Page 319 **1.** 6; 3; 17; 53. **2.** 7; 7 R101; 23 R23; 74. **3.** 7 R102; 3; 24; 41 R20. **4.** 6; 3 R326; 16; 73. **5.** 6 R207; 8; 17; 26. **6.** 8; 9 R10; 19; 64. **7.** 76; $77\frac{143}{271}$; 194. **8.** $37\frac{211}{427}$; 79; 419. **9.** $51\frac{309}{352}$; $49\frac{2}{13}$; 384. **10.** 67; $58\frac{401}{634}$; 659. **11.** $44\frac{4}{9}$; $79\frac{25}{63}$; 787. **12.** $195\frac{341}{412}$; $259\frac{1}{4}$; $643\frac{108}{169}$. **13.** 97 R800; 417 R70; 573 R19. **14.** 71 R42; 223; 547. **15.** 52; 73 R125; 254. **16.** 42; 334; 275. **17.** 279; 66; 543. **18.** 53; 62; 627.

Page 320 **1.** 12; $11\frac{2}{3}$; 12; 32; 20. **2.** 8; $7\frac{1}{2}$; $6\frac{2}{3}$; 32; $10\frac{2}{3}$. **3.** 8; 8; $2\frac{2}{7}$; $22\frac{1}{2}$; 36. **4.** $2\frac{2}{3}$; $7\frac{1}{2}$; $10\frac{4}{5}$; $22\frac{1}{2}$; $26\frac{2}{3}$. **5.** 6; 20; $6\frac{2}{3}$; 18; 48. **6.** $1\frac{2}{3}$; $5\frac{3}{5}$; $1\frac{1}{2}$; $\frac{1}{6}$; $1\frac{1}{8}$. **7.** 8; 10; $7\frac{1}{5}$; $1\frac{1}{3}$; $\frac{4}{5}$. **8.** $5\frac{1}{2}$; 10; $1\frac{11}{16}$; $3\frac{1}{3}$; $\frac{1}{4}$. **9.** $10\frac{2}{3}$; $4\frac{3}{8}$; $\frac{5}{6}$; $3\frac{1}{2}$; $\frac{5}{6}$. **10.** $1\frac{11}{16}$; 6; $\frac{9}{10}$; $1\frac{1}{3}$; $\frac{3}{4}$. **11.** 2; 4; $1\frac{1}{8}$; $1\frac{3}{5}$; $4\frac{4}{5}$. **12.** $2\frac{1}{4}$; 22; $2\frac{1}{12}$; 4; $2\frac{1}{4}$. **13.** $7\frac{1}{3}$; 20; $5\frac{1}{3}$; $\frac{2}{3}$; $\frac{5}{8}$. **14.** $3\frac{1}{3}$; $1\frac{3}{5}$; $1\frac{1}{5}$; $1\frac{1}{3}$; $\frac{24}{25}$. **15.** $3\frac{3}{5}$; $10\frac{1}{2}$; $3\frac{3}{4}$; 10; $1\frac{1}{3}$. **16.** $\frac{1}{8}$; $\frac{3}{16}$; $\frac{5}{6}$; $1\frac{1}{4}$; $\frac{3}{4}$. **17.** $\frac{1}{8}$; $\frac{3}{32}$; $1\frac{1}{4}$; $\frac{3}{10}$; $\frac{3}{16}$. **18.** $\frac{2}{15}$; $\frac{3}{10}$; $1\frac{3}{4}$; $\frac{7}{8}$; $\frac{3}{4}$. **19.** $\frac{1}{10}$; $\frac{11}{32}$; $1\frac{1}{16}$; $1\frac{2}{3}$; $\frac{1}{6}$.

Page 321 **1.** $7\frac{1}{5}$; $\frac{3}{4}$; $1\frac{1}{8}$; $1\frac{1}{24}$. **2.** $\frac{5}{12}$; $\frac{1}{2}$; $1\frac{1}{4}$; 36. **3.** $\frac{5}{6}$; 24; $6\frac{3}{4}$; 8. **4.** 3; $\frac{2}{3}$; 24; 4. **5.** $1\frac{1}{4}$; $2\frac{1}{2}$; $1\frac{1}{2}$; $7\frac{1}{5}$. **6.** 27; $6\frac{2}{3}$; $\frac{5}{6}$; $\frac{5}{8}$. **7.** $\frac{1}{2}$; 33; 30; 4. **8.** 4; 5; 12; \$.80. **9.** $\frac{1}{5}$; $3\frac{1}{5}$; $4\frac{1}{6}$; \$.30. **10.** $4\frac{4}{5}$; $2\frac{2}{3}$; $2\frac{3}{4}$; \$.12. **11.** $\frac{3}{4}$; 3; $2\frac{4}{5}$; \$.20. **12.** $\frac{1}{6}$; $\frac{1}{4}$; $\frac{3}{20}$; \$.30. **13.** $\frac{1}{5}$; $\frac{3}{4}$; 2; \$.30. **14.** $\frac{2}{3}$; 2; 20; \$.48. **15.** $2\frac{2}{3}$; $2\frac{1}{2}$; $\frac{2}{5}$; 10. **16.** $\frac{1}{2}$; $\frac{3}{16}$; $2\frac{1}{2}$; $\frac{4}{25}$. **17.** $1\frac{1}{3}$; $\frac{1}{6}$; $\frac{1}{2}$; $4\frac{1}{6}$. **18.** $3\frac{1}{3}$; $2\frac{2}{3}$; $\frac{2}{3}$; $\frac{1}{2}$. **19.** $\frac{1}{4}$; $\frac{1}{3}$; $\frac{2}{3}$; $\frac{2}{3}$. **20.** $1\frac{2}{3}$; $1\frac{1}{3}$; $1\frac{7}{8}$; $\frac{5}{6}$.

Page 322 **1.** 3; 205. **2.** 3; 410. **3.** 2; 82. **4.** $2\frac{1}{2}$; $33\frac{1}{3}$. **5.** $2\frac{1}{4}$; $37\frac{1}{3}$. **6.** $1\frac{1}{2}$; 60. **7.** 16; 64; 180. **8.** 8; 48; 80. **9.** 20; 54; 32. **10.** 36; 72; 60. **11.** 12; 105; 72. **12.** 72; 42; 72. **13.** 2.3; .35; .89; 6.5; 5.8. **14.** .6; 13.5; 4.7; .87; .142. **15.** .14; .124; .214; .44; 21.3. **16.** 2.9; .229; .98; 17.3; 2.56. **17.** 4.8; .93; 1.07; .89; 4.7.

Page 323 **1.** 1.5; 5.5; 54.6; 75.5; 26.75. **2.** 1.8; 4.5; 98.5; 49.5; 239.5. **3.** 3.5; 3.2; 67.5; 78.25; 18.25. **4.** 1.5; 4.75; 37.25; 96.4; 423.5. **5.** 1.75; 5.6; 179.5; 42.5; 65.8. **6.** 1.25; 1.875; 3.16; 1.25; 1.65. **7.** 2.25; 2.4; 1.875; 1.125; .864. **8.** 3.5; 8.375; 7.75; 1.5; 2.375. **9.** 1.6; 3.75; 1.75; 2.36; 1.85. **10.** 1.5; 2.375; 1.88; 1.5; 2.45. **11.** 1.125; 6.6; 2.875; .625; 2.436. **12.** 1.4; 6.625; 6.5; 2.52; 2.35. **13.** .17; .67; .71; .27; .92; .27; .18; .25. **14.** .11; .78; .83; .42; .13; .45; .34; .86. **15.** .33; .57; .56; .87; .36; .82; .84; .75. **16.** .22; .89; .14; .85; .79; .94; .83; .46.

Page 324 **1.** 9.25; 7.25; 7.76; 18.75; 8.5. **2.** 9.375; 3.25; 14.75; 9.16; 2.875. **3.** 19.8; 4.875; 35.72; 43.5; 25.16. **4.** 11.75; 15.56; 12.875; 9.5; 47.25. **5.** .25; .875; .625; 1.45; 1.175. **6.** .875; .52; .72; 1.15; 2.42. **7.** .8; .75; .625; 1.25; 2.95. **8.** .125; .74; .72; 1.65; .936. **9.** $4\frac{4}{9}$; 10; $6\frac{2}{3}$; $\frac{5}{8}$; $4\frac{1}{6}$. **10.** $6\frac{3}{4}$; 18; $31\frac{1}{2}$; $\frac{15}{16}$; 6. **11.** 18.2; .221; .091; .26; 65.0. **12.** $1\frac{5}{6}$; $1\frac{2}{3}$; $3\frac{11}{12}$; $1\frac{3}{4}$; $2\frac{1}{3}$. **13.** $4\frac{3}{8}$; 5; 2; $\frac{5}{6}$; 1. **14.** 8; 23; 247. **15.** 7; 96; 536. **16.** 15; 24; 809. **17.** 19; 35; 617. **18.** 4; 18; 485. **19.** 26; 67; 329.

Page 325 **1.** 89; 87; 94. **2.** 73; 65; 78. **3.** 64; 39; 56. **4.** 52; 46; 84. **5.** .7; 7; .5; 2.18; 1.8. **6.** .4; 6.3; .2; 2.5; 22.7. **7.** .6; 2.7; .5; .6; 63.5. **8.** .5; 1.9; 5.8; 3.6; .2. **9.** 1.0; 8.75; 1.8; 1.5; .2. **10.** .5; 7.25; 5.3; 2.8; 38.1. **11.** 7.5;

86; 1.7. **12.** 7.6; 43.5; .7. **13.** 6.2; 62.4; .1. **14.** 6.7; 89.8; 3.3. **15.** 8.1; 49.8; 1.8. **16.** 8.0; 88.2; .2. **17.** 7.9; 87.5; .7.

Page 326 **1.** 144 cu. ft.; 672 cu. in.; $\frac{1}{2}$ cu. ft. or 864 cu. in. **2.** 756 cu. ft.; 450 cu. in.; $\frac{3}{8}$ cu. ft. or 648 cu. in. **3.** 512 cu. ft.; 1008 cu. in.; $22\frac{1}{2}$ cu. ft. or 38,880 cu. in. **4.** 420 cu. ft.; 312 cu. in.; $\frac{1}{2}$ cu. ft. or 864 cu. in. **5.** 13 ft. 9 in.; 7 ft. 8 in.; 11 hr. 30 min. **6.** 8 da. 1 hr.; 8 bu. 2 pk.; 10 yd. **7.** 6 lb. 3 oz.; 5 qt. 1 pt.; 1 da. 16 hr. **8.** 2 lb. 12 oz.; 10 in.; 1 da. 8 hr. **9.** 76; 6; $4.64; $78.26. **10.** 14; 7; $2.76; $104.86. **11.** 68; 63; $57.62; $106.25. **12.** 45; 45; $41.16; $174.93.

Pages 327–329

Aim: To present "Suggestions to Teachers"

Audio-Visual Aids

Films: The following films are 16 mm. motion pictures and are listed alphabetically according to producer or distributor. A request for additional information will usually bring excellent material concerning the objectives of the film, its cost, and its nearest point of distribution.

Coronet Films, Coronet Building, 65 East South Water Street, Chicago 1, Illinois.

Decimals Are Easy
Division Is Easy
Language of Graphs
We Discover Fractions

Encyclopedia Britannica Films, Inc., 1150 Wilmette Avenue, Wilmette, Illinois.

What Are Decimals?
What Are Fractions?

Johnson Hunt Productions, 1104 Fair Oaks Avenue, S. Pasadena, California.

Introduction to Fractions
How to Change Fractions
How to Add Fractions
How to Subtract Fractions
How to Multiply Fractions
How to Divide Fractions
Decimal Fractions

Knowledge Builders, Visual Education Building, Floral Park, New York.

Multiplying Fractions
Division of Fractions
How to Use Decimals
Measuring Simple Areas
Simple Fractions

Filmstrips: You should communicate directly with the producer or distributor listed below before ordering these filmstrips. The sales information which you will receive will assist you in determining the effectiveness of these filmstrips for your particular classroom. The names of the distributors and producers are listed aphabetically.

Curriculum Films, Inc., Curriculum Materials Corp., 10031 Commerce Avenue, Tujunga, California.

What Is a Fraction?
Writing Fractions; Mixed Numbers; Common Denominators
Adding Fractions
Multiplying Fractions by Fractions
Using Mixed Numbers

Filmstrip House, 347 Madison Avenue, New York 17, New York.

Decimal Whole Numbers
Decimal Fractions — Tenths
Decimal Fractions — Hundredths
Adding Decimal Numbers
Decimal Fractions — Subtraction
Decimal Fractions — Multiplication
Decimal Fractions — Division
Decimal Fractions — Extending Division and Multiplication

Jam Handy Organization, 2821 East Grand Boulevard, Detroit 11, Michigan.

Addition and Subtraction of Fractions
Multiplication and Division of Fractions
Comparing Fractions
Graph Uses

Society for Visual Education, Inc., 1345 Diversey Parkway, Chicago 14, Illinois.

Meaning of Fractions
Changing the Terms of Fractions
Adding Like Fractions and Mixed Numbers
Adding Unlike Fractions and Mixed Numbers
Subtracting Unlike Fractions and Mixed Numbers
Multiplying Fractions and Mixed Numbers
Dividing Fractions and Mixed Numbers

Text-Film Department, McGraw-Hill Book Company, Inc., 330 West 42 Street, New York 36, New York.

Two Figure Divisors
Dividing a Whole Number by a Fraction
Meaning of Decimals
Dividing with Decimals
History of Measures (6 strips)

Charts, Devices, and Games: The items listed below are arranged alphabetically:

H. G. Ayre, Western State Teachers College, Macomb, Illinois.

History of the Standard Units of Measurement (a set of 8 x 10 cards)

Brown and Sharpe Manufacturing Company, Dept. 43, Providence, Rhode Island.

Decimal Equivalent Chart

Cornell Rural School Leaflet, New York State College of Agriculture, Cornell University, Ithaca, New York.

Let's Measure Things

Ford Motor Company, Dearborn, Michigan.

How Long Is a Rod?

Holt, Rinehart and Winston, Inc., 383 Madison Avenue, New York 17, New York

Number as the Child Sees It
Spinno

Ideal School Supply Company, 8316 S. Birkhoff Avenue, Chicago 20, Illinois.

Fraction Wheel
Fractions Made Easy

L. R. Learning Aids, 854 Howard Street, Detroit 26, Michigan.

Place Value Chart
Whole Numbers and Decimal Fractions

F. A. Owen Publishing Company, Dansville, New York.

Decimals
Using Decimals (Parts I and II)
Fraction Chart
More Fractions
Adding Fractions

Plaza Manufacturing Company, Inc., 5 East 17 Street, New York 3, New York.

Fiddlestix (an addition and multiplication game)

The Steck Company, Box 16, Austin 61, Texas.

Fraction Cards (10)

The companies listed below will gladly send their catalogues upon request:

Milton Bradley Company, 74 Park Street, Springfield 2, Massachusetts
J. L. Hammett Company, Kendall Square, Cambridge 42, Massachusetts
Holt, Rinehart and Winston, Inc., 383 Madison Avenue, New York 17, New York
The Judy Company, 310 North Second Street, Minneapolis 1, Minnesota

Remedial-Special Instructional:

Dana and Company, Box 201, Barrington, Rhode Island.
Ready Arithmetic Review — a series of 40 self-correcting arithmetic cards which have been scientifically developed. A Teacher's Manual accompanies these cards and explains their use.

Puzzles — Brainteasers — Interesting Arithmetic: These items are for the intelligent pupil who wants to be challenged by arithmetic:

1. If it takes 3 minutes to boil an egg, how many minutes will it take to boil 3 eggs? (*Ans.* 3 minutes — put them all in the same pot.)
2. A man looked in his wallet and noticed that he had 6 bills. They totaled $63.00. None of these were $1.00 bills. Can you tell what bills he had in his wallet? (*Ans.* One $50.00 bill, one $5.00 bill, and four $2.00 bills.)
3. Assume that you have a 3-gallon measure and a 5-gallon measure. What you want to do is measure out exactly 4 gallons of water. How can you do it using only these 2 measures? (*Ans.* Fill the 3-gallon measure and pour the water into the 5-gallon measure. Fill the 3-gallon measure again and pour as much of this water as you can into the 5-gallon measure. There will then be 1 gallon in the 3-gallon measure. Dump the water out of the 5-gallon measure and pour the 1 gallon from the 3-gallon measure into the 5-gallon measure. Now fill the 3-gallon measure again and dump it into the 5-gallon measure. There are now 4 gallons in the 5-gallon measure.)
4. A farmer was asked how many ducks he had. "Well," he said, "they ran down the path just now and I saw one duck in front of two ducks, a duck behind two ducks, and a duck between two ducks." (*Ans.* There were 3 ducks, one in front of another.)
5. If you know your nursery rhymes and stories, you can do this one: Multiply the number of men in a tub by the number of days the pease was in the pot. Subtract from that answer the number of blackbirds baked in a pie. Then add the number of wives of the man who was met on the road to St. Ives. Add to that figure the number of thieves Ali Baba met. What number do you get? (*Ans.* 50 — Explanation: $3 \times 9 = 27$; $27 - 24 = 3$; $3 + 7 + 40$.)
6. Think of a number less than 10. Multiply it by 2 and add 10. Take one half of the answer and then subtract the number you started with. You will have 5 left.

7. A group of hunters went out for rabbit and quail. When the hunt was over, one of the men collected the dead rabbits and birds. He was asked the total count and replied; "36 heads and 100 feet."
How many rabbits and how many quail were shot? (*Ans.* 14 rabbits and 22 quail.)

8. *Magic Squares with Common Fractions*
In a magic square the sum of the numbers in each row, each column, and each diagonal must be the same. (The numbers in red should be omitted in showing the pupils the puzzle.)

Is This a Magic Square?

1	$\frac{1}{8}$	$\frac{3}{4}$
$\frac{3}{8}$	$\frac{5}{8}$	$\frac{7}{8}$
$\frac{1}{2}$	$1\frac{1}{8}$	$\frac{1}{4}$

Sum: $1\frac{7}{8}$

Make This One a Magic Square

3	$\frac{3}{8}$	$2\frac{1}{4}$
$1\frac{1}{8}$	$1\frac{7}{8}$	$2\frac{5}{8}$
$1\frac{1}{2}$	$3\frac{3}{8}$	$\frac{3}{4}$

Sum: $5\frac{5}{8}$

9. *Magic Squares with Decimal Fractions*

Is This a Magic Square?

2.0	.25	1.5
.75	1.25	1.75
1.0	2.25	.5

Sum: 3.75

Make This One a Magic Square

3.0	.375	2.25
1.125	1.875	2.625
1.5	3.375	.75

Sum: 5.625

10. Think of any number; double it; add a number; divide by 2; subtract the original number. The final answer will be $\frac{1}{2}$ of the number you added.

11. Numbers are fun!

1 × 9 + 2 = 1 1
12 × 9 + 3 = 1 1 1
123 × 9 + 4 = 1 1 1 1
1234 × 9 + 5 = 1 1 1 1 1
12345 × 9 + 6 = 1 1 1 1 1 1
123456 × 9 + 7 = 1 1 1 1 1 1 1
1234567 × 9 + 8 = 1 1 1 1 1 1 1 1
12345678 × 9 + 9 = 1 1 1 1 1 1 1 1 1
123456789 × 9 + 10 = 1 1 1 1 1 1 1 1 1 1

Learning Laboratories: The Learning Center, Inc., 53 Bank Street, Princeton, New Jersey, has developed several learning laboratories that can be used with *American Arithmetic, Grade 6*. These laboratories are available in class-size sets, so that each pupil can learn with his own three-dimensional materials at his own desk. With many of the laboratory sets listed below, The Learning Center supplies demonstration models and supplementary materials for the teacher. A Teacher's Manual accompanies each set of laboratories. Discovery sheets are provided for individual use by pupils.

K102 — *Pattern Boards* (Chap. 4)
K105 — *Number Line* (Chap. 1)
K106 — *Colored Rods* (Chap. 1)
K107 — *Time Learning* (Chap. 8)
K108 — *One's Ten's Hundred's* (Chap. 1)
K112 — *Base and Place* (Chap. 4)
K115 — *Simple Fractions* (Chap. 1)
K117 — *Advanced Fractions* (Chap. 1–3)
K118 — *Fraction Equivalents* (Chap. 3–6)
K120 — *Linear Measurement* (Chap. 7–8)
K132 — *Perimeter* (Chap. 3)
K140 — *Geometry* (Chap. 7)

AMERICAN BOOK COMPANY

AMERICAN ARITHMETIC, 2ND EDITION